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# REPORTS

OF THE

# Pennsylvania State Bee-Keepers' Association,

BEING REPORTS OF THE

Second, Third and Fourth Annual Conventions,
With the list of Officers of each year,
A Preliminary Statistical Report of the Bee Industry of Pennsylvania,

AND

The Constitution and By-Laws of the Association.

---

*Published by direction of the Association,*
*in session at*
*Harrisburg, Pa., October 29th, 1907.*

The Edwin J. Anderson
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State College, Pennsylvania

# Beekeeping in Pennsylvania

SOME five years ago our attention was drawn to the fact that many were taking up beekeeping; some for study, some for honey and some for money. Their number has largely increased, and to inform those who are inquiring we have prepared some pamphlets, as follows:

Check Here

○ ¶ MY FIRST EXPERIENCE WITH THE HONEY BEE. By "The Spectator" of The Outlook, New York. A ten-page leaflet detailing the experiences of this well-known writer. You will read the leaflet through before you lay it down. Free.

○ ¶ A CLERGYMAN AND HIS BEES. By "Clericus." A thirty-two-page illustrated booklet telling how a clergyman kept bees to relieve a tired mind, and incidentally secured a crop of honey. Free.

○ ¶ FACTS ABOUT BEES. By F. Danzenbaker. A sixty-four-page illustrated booklet. A practical treatise for the amateur. 10 cents.

○ ¶ HABITS OF THE HONEY BEE. By Dr. E. F. Phillips. A somewhat scientific handling of the habits and anatomy of the bee. 10 cents.

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MR. J. R. RAMBO, Collingdale, Pa.

*Dear Sir* :—I am more than pleased with the Queens I obtained from you. The bees are of beautiful bright color, and hustlers for honey. They wintered well and bred up rapidly in the spring. Yours truly,

EDMUND W. LYNCH,
Sharon Hill, Penna.

October 8, 1908.

MR. J. R. RAMBO, Collingdale, Pa.

*Dear Sir* :—It may interest you to know that the number of Queens which you have supplied to me during 1906 and 1907 have turned out well. I am much pleased with the results. My bees have gradually come to be bright yellow through their breeding. The bees are easily handled and are producting so much honey that it is difficult to get rid of it to my friends. Very tsuly yours,

W. P. WILSON.

PHILADELPHIA, Sept. 28th, 1908.

MR. J. R. RAMBO, Collingdale, Pa.

*Dear Sir* :—The Bees and Queen I bought of you in July have turned out fine. The Queen filled fourteen Langstroth frames solid with brood during August. Her bees are very gentle and hustlers. Youry very truly,

J. T. FENNEL,
Chief Inspector.

R. D. 12, MORAVIA, N. Y., Sept. 1st, 1908.

MR. J. R. RAMBO, Collingdale, Pa.

*Dear Sir* :—The Queens have proved to be purely mated and are extra good layers, but we have not had any honey flow since I got them, therefore, I am unable to say what their workers progeny will do in the way of gathering. Less than one-half crop honey here. Everything dying out for want of rain.

Yours truly,
THOS. BRODERICK.

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HARRISBURG, PA.:
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# Officiary of the Pennsylvania State Bee-Keepers' Assosociation.

## 1906

| | |
|---|---|
| President, | Prof. H. A. Surface |
| First Vice-President, | Rev. D. L. Woods |
| Second Vice-President, | Dr. R. B. Hayes |
| Third Vice-President, | Prof. H. C. Klinger |
| Secretary-Treasurer, | Mr. L. R. White |

## 1907

| | |
|---|---|
| President, | Prof. H. C. Klinger |
| First Vice-President, | Dr. R. B. Hayes |
| Second Vice-President, | Mr. George Rea |
| Third Vice-President, | Mr. J. W. Nelson |
| Secretary-Treasurer, | Prof. F. G. Fox |

## 1907-1908

| | |
|---|---|
| President, | Prof. H. C. Klinger |
| First Vice-President, | Mr. C. N. Greene |
| Second Vice-President, | Mr. I. F. Miller |
| Third Vice-President, | Mr. George Rea |
| Secretary-Treasurer, | Mr. A. F. Satterthwait |

## EXECUTIVE COMMITTEE.

The Executive Committee consists of the Elective Officers.

## Second Annual Meeting.

The Second Annual Meeting of the Pennsylvania State Bee-Keepers' Association was held in Room 114, Main Building, Pennsylvania State College, March 29th and 30th.

The first session was called to order by President H. A. Surface. Dr. W. A. Buckhout, acting as President, welcomed the Bee-Keepers to the college and encouraged them in the efforts they had taken along the line of agriculture—so much neglected.

Mr. Dempwolf, of York, Pa., in a few well chosen words, responded to the hearty welcome.

Prof. Surface then made his Annual Address, speaking of his personal experiences in bee-keeping.

Dr. Phillips, of the Bureau of Apiculture, Department of Agriculture, gave an address on "Recent Developments of Apiculture," speaking principally on diseases of bees and what the Department was doing for it.

Owing to the absence of the Secretary, Rev. D. L. Wood, Mr. L. R. White was appointed temporary secretary. The discussion of topics was deferred until the following session, to be convened in the old chapel, Main Building, at 9:00 A. M., March 30th. The program for the remainder of the session was then read.

The President then appointed Messrs. Merrill, Phillips and Dempwolf on the Resolution Committee, and Messrs. Selser and Pratt on the Memorial Committee. Then adjourned.

The Convention was called to order near the appointed hour, Friday morning March 30th. The first item in the order of the day was a discussion by Mr. Simmons of the subject, "Nucleus Hives." Mr. Simmons had on exhibition some devices of his own—handy and ingenious.

"Old and New Ideas in Bee-Keeping" was the subject of a paper by Mr. L. R. White. The paper was of special interest in that it showed how much more accurate knowledge of the bees is now current.

The Secretary's report was now called for, read and regularly received. The election of officers was then held, resulting as recorded for 1906. On motion, the elective offices were constituted the Executive Committee of the Association.

The Committee on By-Laws, appointed at the organizing meeting, April 12, 1904, was called to report. There being differences of opinion in the committee, there was presented to the convention a majority report by Mr. W. P. Merrill, and a minority report by Mr. E. E. Pressler.

On motion, presented by Mr. W. A. Selser, and regularly seconded, these reports were received, the committee discharged and the whole matter referred to a new committee, whose report should be presented at some future session of this convention. Then adjourned for dinner.

At 1:15 P. M., the President called the convention to order and asked for the report of the Committee on Resolutions, which was submitted, as follows:

Whereas, It is evident, and has been for some time, that an understanding, combination or agreement of some kind or nature exists, for the purpose of advancing and maintaining the price of bee supplies above a necessary and reasonable profit; therefore, be it

*Resolved,* That we, members of the Pennsylvania State Bee-Keepers' Association, recommend the appointing of a committee to correspond with all leading bee-keeping supply manufacturers, and others in a position to manufacture some or all bee-keeping supplies, in order to obtain bids on the articles used by bee-keepers, to be supplied to members of the Pennsylvania Bee-Keepers' Association only; be it further

*Resolved,* That copies of this resolution be forwarded to the different County Associations and as soon as satisfactory arrangements can be made that the members of the State Association be advised where supplies can be purchased at a reasonable price and that this organization advise the use of such exclusively; and, be it

*Resolved,* That we, the members of the Pennsylvania State Bee-Keepers' Association, recommend the amendment of the Constitution so that membership in the State Association does not grant membership in the National Bee-Keepers' Association.

Whereas, The President of the New York State Association of Bee-Keepers' informs us that if we, the Pennsylvania State Bee-Keepers' Association, are disposed to co-operate with the New York State Association of Bee-Keepers, he would cheerfully aid us as far as in his power.

*Resolved,* That we, the Pennsylvania State Bee-Keepers' Association, offer, and our Secretary be ordered to inform Mr. W. F. Marks, (address Clifton Springs, N. Y.), that we appreciate his kind offer and will be very pleased to have him make any suggestions that would aid us or assist the Pennsylvania Bee-Keepers' Association; and we, the Pennsylvania State Bee-Keepers' Association, will try to work in accord with the New York State Association of Bee-Keepers' in a friendly way.

*Resolved,* That we extend our sincere thanks to the authorities of the Pennsylvania State College for their kind hospitality which we have so much enjoyed; and be it further

*Resolved,* That we express our appreciation to our President, Professor H. A. Surface, and to our Secretary, Rev. D. L. Wood, for their untiring efforts in the upbuilding of the society.

Signed: W. P. Merrill.
E. F. Phillips.
E. A. Dempwolf.
*Committee on Resolutions.*

After considerable discussion, the resolutions were adopted.

On motion, and by a rising vote, Mr. E. R. Root, of Medina, Ohio, was given the privilege of the floor on all questions up for discussion in the convention.

Mr. Pratt then addressed the convention on "Recent Observations." Immediately after this address, the question box was opened and all questions bearing on the previous address, or on the more general subject, "Queen Rearing," were referred to Mr. Pratt.

Mr. E. R. Root was then called to address the convention. The subject announced was, "Candied Honey." Mr. Root prefaced his address on the subject by a few words in answer to the question as to "The Cause of the Advance of Prices of Bee-Keepers' Supplies." The principal reasons were the advance in the price of lumber and the great cost of marketing the supplies under the system of branch supply-houses. He stated that the cost of serving the bee-keeper was equal to the first cost of the supply.

At this point in the program Mrs. Surface favored the convention with a selection of music, to the delight of all.

Dr. Frear then addressed the convention on the subject: "Composition of Honey." A vote of thanks was tendered him for his presentation of this subject. The Committee on By-Laws reported, and their report was adopted by the convention, (as given on page 60 of this Report). The convention then adjourned to the bee-yard.

At the evening session, the President in the chair, the program opened with an address by E. R. Root. He spoke successively on several subjects, as follows:

1. Experiments on Granulation of Honey.
2. The Wax Press.
3. Methods of Feeding.
4. Use of Rock Candy.
5. Covers Over Bees in Winter.

Dr. E. F. Phillips was then introduced and delivered a most interesting address on "The Structure and Anatomy of the Honey Bee." The stereopticon illustrations presented with the lecture made it most instructive and helpful.

R. D. Barclay then spoke about "Methods of Keeping Records."

The question of time and place for next meeting was brought up and discussed with varying opinions. After several futile attempts to determine a place, it was finally agreed to hold the next convention at Altoona. On motion, presented by Mr. Pressler, and regularly supported, it was decided that the time of next convention be October or November, and that it be held in conjunction with New York Convention, if possible.

On motion, Rev. H. H. Stiles, of Altoona, was asked to act as a local secretary, to assist the work of the Association at its next meeting.

On motion, an order was drawn for ($15.00) fifteen dollars, to pay postage, etc., in favor of Mr. White, our Secretary.

On motion an order on the Treasurer was drawn in favor of Dr. E. F. Phillips for ($10.00) ten dollars, to re-imburse him for coming to this convention.

On motion it was ordered that minutes be read at next meeting. A vote of thanks was extended President Surface for his efficient service in behalf of this Association, and especially for the success of this convention. Adjournment, sine die.

D. L. Wood, *Assistant Secretary by Request.*
L. R. White, *Secretary-Treasurer.*

The Third Annual Meeting of the Pennsylvania State Bee-Keepers' Association was held in the audience room of the Department of Public Instruction, January 17th, 18th and 19th, 1907.

The meeting was called to order and opened with prayer by President Surface. The minutes of the previous meeting were read by the Secretary, L. R. White, and were approved as read.

Then followed the report of the Secretary, which showed that the Association had been making a steady growth, and at this time there were 146 paid members. This was followed by a report of the Treasurer. It was found that the financial condition of the Association was very encouraging.

The President, Prof. Surface, then delivered his annual address, as follows:

The Secretary-Treasurer has explained that the reason we did not hold this meeting in Altoona was because it was put to a vote among the members, by correspondence, and almost universally the vote was for having it in Harrisburg. Hence we are here. Since our last annual meeting a memorable Bee-Keepers' Meeting has been held in Pennsylvania, under the auspices of the A. I. Root Company, at the apiary of Mr. W. A. Selser, near Jenkintown, north of Philadelphia. This was a great success, as hundreds of interested persons were present, and there were many prominent speakers from different parts of the United States. The A. I. Root Company, of Medina, Ohio, was directly responsible for this meeting in every regard, and the statement that it would be a meeting of the Pennsylvania State Bee-Keepers was an error. No member of our Association officially was connected with it in any way, although the speaker was present in his official capacity (as State Zoologist), and presided at one of the sessions.

As one of the outcomes of the Jenkintown meeting, one of our orchard demonstrators, who was present, gave a public exhibition of the method of transferring bees from old hives to new modern frame hives, in Monroe County, and greatly stimulated the interest there in Bee-Keeping. It is believed that a demonstration at the county fairs of the methods of transferring bees, would be a most attractive feature, a good advertisement for bee-keepers, and possibly a good means of making honey sales.

The bee-keepers in Lebanon County have awakened, and have united their efforts in forming the Lebanon County Bee-Keepers' Association, which is active and successful. Your President recommends encouraging branch associations in the various counties of this state, and would be glad to see special fees made to members of such associations to induce their joining the local organizations as well as the State and National.

Some experiments were conducted during the past summer, which gave some interesting results. Among other things, it was found that new colonies of bees could be made by dividing and introducing queens as late as the 26th of September, provided stimulative feeding followed, and both colonies were fed abundantly not only to rear more bees, but also to lay in a proper amount of winter stores. One of the best feeders to use during the fall, if the honey flow is scarce, is the "Alexander Feeder," which is a narrow trough, placed under the rear of the hive, with a projecting end into which the liquid is poured. This is a good feeder for rapid work, but its chief objection is that rain water is very liable to enter it by running down the sides of the hives, and will thus make difficulty. A board to cover the projecting end should be leaned against the side of the hive, so as to turn the rain water from the feeder.

The form of bee feeder known as "Pratt's Feeder," was found very good and convenient by simply placing it on sticks about the thickness of lead pencils to support it over the frames, and pouring in the liquid food after removing the cover of the hive. This feeder is especially to be recommended for stimulative feeding during the early part of the summer. Such feeding induces the rearing of strong colonies, and is to be urged upon our members. For this stimulative feeding we find a good formula to be one pint of sugar, two pints of water, and enough honey to give flavor, in order to induce the bees to take it up readily. The sugar is to be stirred into the water when hot until it is dissolved, when the liquid should be allowed to cool to a temperature of the hand, and never fed hot. In the fall, as the weather becomes cooler, in feeding for winter stores, it can be made thicker or according to the formula of one part of sugar to one part of water, or equal parts, by measure.

During a portion of the winter, especially during the latter part of January, the weather becomes so warm that the bees consume a great deal of food and many demanded feeding, which would otherwise have died of starvation. One of the best means of feeding during mid winter when the bees should be unduly active consists of giving them sugar boiled with water and strained or stirred until it is well granulated and poured into flat pans to cool, and then fed as a block placed over the frames within the hive, but beneath the chaff cushions. However, the best possible winter feed consists of frames of sealed honey set into the hives when needed.

It was found that one of the chief evils of wintering bees is the moisture which may come either from a lack of ventilation in the hive, due to the hive opening being too small, or to a quantity of unsealed honey in the combs. Remove the unsealed combs in the fall, and return them in the winter or spring as the bees need them, rather than to have the hives filled with moisture from them. It was found that the least possible amount of actual honey upon which a colony of bees should be expected to go into the winter was fifteen pounds of sealed stores, and twenty-five pounds is to be considered the proper average amount, though in some seasons they may need forty pounds. Of course, twice this amount, or fifty pounds, will do no harm, because what is not used in the fall and winter, will be readily available for rearing young bees in the spring.

It was found by actual experimentation that robbing could be prevented, or even stopped, by painting the hive with fresh paint, in order to give them an offensive odor for the bees that were marauding. Especially the cracks around the hive should be painted with fresh paint or kerosene oil, and the opening at the front of the hive should be contracted to a quarter of an inch, and the front board painted with oil paint or oil of some kind, and a small piece of glass set slanting over the opening.

It was found that painting the bottom boards on both sides not only prevented warping by moisture, but also prevented the bee moth entering so readily, and prevented the moth larvæ from finding suitable places to hide in the cracks. Painting the edges and inner sides of supers, as well as bottom boards, also prevented an excessive amount of propolis being deposited, particularly on the tin rabbits which support the frames, and the bees use less wax in sealing the frames to place.

One experiment of considerable importance and interest to bee-keepers as well as fruit growers was the placing of grapes and plums in the top of a bee hive. Some of the grapes were punctured by me and others were not, and it was found at once that the punctured ones were sucked dry by the bees, while those that were left entire were uninjured. On a tray we placed three sets of plums, ''A'', ''B'', and ''C''. ''A'' was composed of plums ripe but with unbroken skin; ''B'' represented plums ripe, but the skins broken by the ripe rot, and ''C'' represented plums likewise ripe, and in the same condition as ''A'', but the skins punctured by pins. These were placed on frames in the hives and left there not only all fall, but during the winter, and were forgotten, and removed from the hive only to-day. It can be seen that the punctured plums were sucked dry by the bees, the flesh eaten out, and nothing but the skins and stones remained. The decayed plums were partially sucked by the bees, but were not cleaned out as were those that were sound, yet the sound and uninjured plums were not attacked, and simply dried or shriveled like prunes. This shows again what we already know by other tests, that bees can not of their own accord puncture the skins of fruits, and where they are seen working on fruits, it is only where holes have already been made by other insects, such as yellow jackets, hornets, or other species.

This Association needs members in every part of the state to further legislation in behalf of the bee-keepers. We need State Inspectors to detect the diseases of bees, which we know exist in several different counties, and we need legislation regarding these diseases. Not only that, but we are now obliged to say that we need legislation to prevent spraying trees when in bloom. It is remarkable that any fruit grower should be so blind to his own interests as to spray his trees when in bloom, and thus be in danger of destroying the fruit, as well as the bees that are necessary to carry pollen to insure a good crop.

With earnestness in co-operation and good fellowship we hope to go forward and achieve such success in the future as we have met in the past. Our Pennsylvania State Bee-Keepers' Association is to be congratulated upon the success of closing its second year and its propitious view into the third year of its existence.

H. A. Surface, *President.*

3rd meeting

Friday, January 18th, 1907. The meeting was called to order by President H. A. Surface. The amendments to the Constitution received first consideration.

First amendment.—That 50 cents of each dollar received by the Secretary be paid over for membership in the National. This subject was thoroughly discussed, both *pro* and *con,* and finally carried.

Second amendment.—To regulate fees for the Local, State and National Associations. Lost.

Third amendment was postponed.

Next in order was the election of officers for 1907, which was conducted with the results recorded on page 5.

The newly elected officers assumed their offices at once, and the business of the convention was continued.

A committee to see what could be done in the way of regulating the dues between the Local, State and National Associations, was appointed, composed of the Rev. H. W. Bender and Messrr. S. K. Snyder and F. G. Fox.

This the third amendment provided: That members of the State Association be limited only to residents of the State, except by unanimous vote of the Association. The amendment was adopted.

A letter was read from Frank Benton, with which he sent one dollar for his membership. On motion, he was unanimously elected a member. A vote of thanks was given to Prof. Surface for his untiring efforts and the credential work which he had done in behalf of the Association.

Dr. Phillips then read portions of the following excellent paper, entitled ''The Present Status of the Investigation of Bee Diseases'':

## The Present Status of the Investigation of Bee Diseases.

**By E. F. Phillips, Ph. D.,**

**Of the U. S. Deparment of Agriculture.**

I wish to take up two or three phases of this work about which Doctor White has been speaking, and to add some additional points. In regard to the history of the investigation of bee diseases prior to 1885, I can do no better than to quote the historical resume contained in a paper by Prof. F. C. Harrison, entitled ''Foul Brood of Bees,'' published as Bulletin 112 of the Ontario Agricultural College:

> In all probability the first definite reference to foul brood is by Aristotle (Historia Animalium, Book IX, ch. 27), who mentions an inertness which seizes the bees and causes a bad smell in the hive. He also suggests that bees are liable to become diseased when the flowers on which they work are attacked by blight. Bee dysentery as well as foul brood causes a bad odor; but in the former disease the spotting and consequent smell are usually outside the hive.
>
> Columella (De Re Rustica, Book IX, ch. 13) mentions a bee pestilence and an annual distemper which seizes the bees in spring. Pliny (Natural History, Book XI, ch. 19, A. D. 79) writes of a disease of bees, but as he uses the same term as Aristotle he has probably copied it from the latter author.
>
> Schirach (Histoire des Abeilles, ch. III, p. 56, La Haye, 1771), in 1769, was the first writer to name the disease ''foul brood.'' He says:
>
> It is dangerous and a most destructive disorder to the bees, a genuine plague when the complaint has reached a certain stage. The cause can be attributed to two sources: (1) The putrid (or tainted) food with which the bees feed the larvæ for lack of having better. (2) By the mistake of the queen bee in misplacing the larvæ in their cells, head upside down. In this position the young bee, unable to get out of its prison, dies and rots away.
>
> Further, Schirach clearly distinguishes between foul brood and chilled brood, and mentions the fact that putrefaction follows the death of the brood from frost, but in this case ''it is only an accident and not a disease.''
>
> The remedy Schirach recommended was to remove all diseased combs from the infected hives and to keep the bees fasting for two days, after which they are furnished with other cakes of wax and a suitable remedy given, ''as a little hot water mixed with honey, nutmeg, and saffron, or a syrup composed of equal parts of sugar and wine seasoned with nutmeg.'' Thus, as Cowan (Journal of the Royal Agricultural Society, Vol. VI, Part IV, 1895) remarks: ''We had given us nearly one hundred and thirty years ago a method of cure almost identical with what is by some claimed as new to-day.''
>
> Tessier (L'Encyclopedie Methodique, Abeille, p. 32, 1765) about the same time as Schirach says that when the larvæ die in their cells it causes an infection in the hive which makes the bees sick. It is then necessary to drive away or sometimes move the bees from the hive, and to take care to fumigate the infected hive if it is going to be used again. It is necessary, in order to avoid the same inconvenience, to take out the parts of the comb that may be

moulded by reason of the dampness. Duchet (Culture des Abeilles, p. 315, Vevey, 1771), who wrote on bees in 1771, does not mention any disease that can be certified as foul brood, but he describes bee dysentery.

Della Rocca (Traite Complet sur les Abeilles, Vol. III, p. 261, Paris, 1790), vicaire-general of Syra, an island in the Levant, relates with much detail the history of an epidemic of foul brood, which caused great destruction in the island during the years 1777 to 1780. Della Rocca describes very minutely the symptoms, destruction, and mistakes that were made in attempting to combat the disease. He says:

The disease manifests its presence by defects in the combs filled with brood, and which only contain a putrid mass; instead of the bee pupæ there is only rottenness in the cells, which, however, being capped, always preserve a healthy appearance. If these cells are broken open, a blackish liquid flows out, which spreads the infection through the hive. This disease only manifests itself in cells which contain a nearly mature larvæ or a capped one. The bees themselves remain in good health, and work with the same activity, but their numbers decrease daily. This disease, however, was not so general in a hive but that a small portion escaped. Some new bees emerged, but in too small numbers to supply the daily losses. Thus a hive attacked by this scourge will perish from scarcity of population. At first it was not noticed that this disease was epidemic, and the hives emptied by death of the bees were filled with fresh swarms, and these contracted the same disease and perished. Yet another mistake was made. The remains of the hives that were lost were taken into the streets of the town to expose them to the sun in order to extract all the wax, and the bees from the neighborhood sucked up the honey, caught the disease, and communicated it to other hives, and all, without exception, perished in a short time. The epidemic having reached the island spread everywhere, and the mortality among the bees was general, either from eating infected honey, or from stopping up the infected combs, or from the bees nourishing their brood on infected honey.

Della Rocca criticises Schirach's statement regarding the misplacement of the larvæ by the queen as a cause of the disease, because ‘‘everybody knows that the queen has nothing else to do but deposit eggs. These are then cared for and nourished by the bees; and when the larva is nearly ready to change into the pupa, the bees close the cell, and every position which is given the larva depends on their good pleasure and not on the queen's.’’ Della Rocca himself thinks that ‘‘some pestilential blight had without doubt corrupted the quality of the honey and the dust from the anthers,’’ and recommends ‘‘burning everything without pity, as there is no other resource when the disease is well established, as the pest is without doubt the most terrible in the natural history of bees.’’

Neither Wildman (Treatise on the Management of Bees, London, 1796), Keys (Ancient Beemasters Farewell, London, 1796, Woolridge), Needham (Brussels Memoirs, Vol. II, 1780, Rhein), Reaumur (Memoirs pour Servir a l'Histoire Naturelle des Insectes, T. V., p. 1734), and other authors about the same time (latter end of the eighteenth century) mention this disease.

Bevan (The Honey Bee, London, 1827) names the disease ‘‘pestilence,’’ and also quotes Schirach's name, ‘‘foul brood,’’ and says regarding it that the ‘‘pestilence has been attributed to the residence of dead larvæ in the cells, from a careless deposition of ova by the queen. * * * It has also been attributed to cold and bad nursing; that is, feeding with unwholesome food.’’

Nothing further of note appears in bee literature till the year 1860, when Doctor Leuckhart (Bienen Zeitung, Eichstadt, 1860, p. 232) writes that he was formerly of the opinion that foul brood was caused by the same fungus (*Panhistophyton ovatum*) which is noticed in a disease of the silkworm, but now, after observation and experiment, is quite certain that the disease is caused by neither vegetable nor animal parasite. He also notes that the term ‘‘foul brood’’ is applied to a number of diseases affecting bees.

Molitor Muhlfeld (Bienen Zeitung, Eichstadt, 1868, p. 95) recognizes two forms, one contagious and the other not contagious, and thinks that the only cause of contagious foul brood is a fly (*Ichneumon apium mellificarium*) which lays its eggs on the young larvæ of the bee.

A discovery of note was Preuss's (Bienen Zeitung, 1868, p. 225), in 1868. He contradicts Muhlfeld's statement about the fly, and states that foul-brood cells can be detected by the sunken cap. With a microscope magnifying 600 diameters he found small, dust-like bodies, with a diameter of 1-500 mm., belonging to the genus *Cryptococcus* (Kutzig), and called the specific form *alvearis,* likened it to the fermentation fungus (*Cryptococcus fermentum*), and thought that the last germ gained access to the young bee and changed to *Cryptococcus alvearis.* He notices that many experts lay the cause of the disease to fermenting food, but the larvæ are easily contaminated by the fermentation fungus, which is always present in the air. He also mentions the enormous rapidity with which the fungus multiplies, and gives an elaborate calculation of the number that might be found in a cell containing a deceased larva.

As might have been expected, Preuss's statement aroused considerable discussion at the meeting of German bee-keepers a short while after the publication of his paper.

Vogel (Bienen Zeitung, Nos. 21 and 22) expressed doubt as to whether *C. alvearis* was the real cause of foul brood or only a consequence of the disease, but on the whole agreed with Preuss.

Wiegand (Bienen Zeitung, Nos. 21 and 22) agreed with Preuss's theory, and in giving his experience said that the disease was introduced into his apiary through honey brought from a distance.

Pollman (Bienen Zeitung, Nos. 21 and 22) believed that the disease was introduced by feeding honey from Havannam, where, when extracting the honey, both brood and honeycomb were mashed up and the honey pressed out.

Doctor Leuckhart (Bienen Zeitung, Nos. 21 and 22) agreed with those who thought the disease due to a fungus, but discredited the supposition that it was the same as the fermentation fungus mentioned by Preuss, and rather thought it was related to the silkworm fungus and that most of the brood diseases ending in death were called ‘‘foul brood,’’ while they were really something else. He believed that the fungus was present in the eggs of the queen when laid.

Geilen (Bienen Zeitung, Nos. 21 and 22) believed that the disease came from the putrefying remains of animal bodies upon which the bees alighted.

Muhlfeld (Bienen Zeitung, 1869, No. 3) again, in 1869, presented his former views and also those of Preuss and gave directions for maintaining the health of bees. He recommended the boiling of the honey and a use of carbolic acid in the strength of 1: 100, or permanganate of potash 1: 300, as disinfectants.

Lambrecht (Bienen Zeitung, 1870, No. 2) thought that foul brood was caused by fermentation of the bees bread.

Hallier (Bienen Zeitung, 1870, No. 2) considered it no specific disease, but thought it was probably produced by different fungi.

Cornallia (Bienen Zeitung, 1870, No. 5) proved contrary to the above and found a fungus which he thought developed foul brood. He called it *Cryptococcus alvearis* and used carbolic acid, potassium permag, and lime water as disinfectants.

Fisher (Bienen Zeitung, 1871, pp. 105-125) advanced a new foul-brood theory in 1871, which somewhat follows the view of Liebig regarding the silkworm disease and plant diseases. According to this theory, the predisposing cause was insufficient nourishment, especially short stores for winter and spring. Shortage of pollen supply was the next cause. Fisher tried to prove his views by the practical experience of bee keepers and explained that the first result of repeated and continued feeding was an increase in the production of bees; and a consequent disproportion between brood and brood feeders arose, which should be looked upon as another cause of foul brood. The disease, he said, might be lessened or exterminated by applying means to reduce the production of brood, as the removing of the queen and the area which the brood occupied. Foul brood is probably the cause of a quantitative dearth of nourishment and a consequent degeneration of the bees. The appearance of fungus growths was only a secondary matter.

Schonfeld (Bienen Zeitung, 1874, pp. 201 and 261) infected several hives with foul brood, and when it had fully developed he took a comb of the rotten brood to the Physiological Institute at Breslau and had it submitted to a microscopical examination by Doctors Cohn and Eidam (Bien Zeitung, 1874, pp. 201 and 261). This examination showed that in every dead larva and in each foul brood cell, whether the contents were yet white and fluid or brown, tenacious, and ropy, there were to be found long oval bodies, which Preuss called ‘‘micrococci.’’ Close to and among them, Cohn was the first to find, with the most powerful of the five microscopes that were used, a countless number of slender pale rods, joined together, and which he at once identified as bacteria of the genus *Bacillus.* The length of a single rod was about 6 micromillimeters, but many of them were two and three jointed, so that these foul brood bacteria microscopically resembled the anthrax bacteria, though of course they were different physiologically and in the manner in which they acted as ferments.

It is not surprising when we remember the state of bacteriological knowledge in 1870, that Preuss should have mistaken micrococci for the spores of a bacillus.

In 1885 the first investigation which merited close attention was published in the Journal of the Royal Microscopical Society, entitled "The Pathogenic History and History under Cultivation of a New Bacillus (*B. alvei*), the Cause of Disease of the Hive Bee Hitherto Known as Foul Brood," by Frank R. Cheshire, F. R. M. S., F. L. S., and W. Watson Cheyne, M. B. F. R. C. S. One point is here to be especially noticed, there were two authors of this paper. The paper was divided into Part I, Pathogenic History, by Mr. Cheshire, and Part II, History Under Cultivation, by Mr. Cheyne, and with the latter part Mr. Cheshire had nothing whatever to do. Bee keepers are generally giving Mr. Cheshire the credit for this work, but it is clear that Mr. Cheyne, the man who did the bacteriological work, should be the one to get the credit. The description of the disease, contained in Part I, is as follows:

> *The nature of foul brood as a germ disease.*—If a comb be removed from near the center of a healthy hive during the summer months its cells will normally be filled with eggs, larvæ, and pupæ in every stage of development. The eggs as left by the ovipositor of the queen or mother adhere commonly by the end to the base of the cells they occupy, and favored by the high temperature constantly maintained within the hive, the germinal vesicle at about three days matures into a larva ready for hatching. These eggs I have shown as liable to the disease even before they leave the body of the mother, but most careful microscopic examination is needful to make this apparent (and of which I shall speak presently more particularly). On the contrary, the larvæ, which are constantly fed by the workers, so change in appearance soon after infection that a practiced eye at once detects the presence of the disease. Whilst healthy their bodies are of a beautiful pearly whiteness, lying, at first floating, in the abundant pabulum the nurses are ever ready to supply. As they grow they curl themselves at the bottom of the cells until they become too strait for their occupants, which now advance to the head to be in readiness for the cocoon spinning, which follows upon the close of the eating stage. When the disease strikes the larvæ they move uneasily in their cells, and often then present the dorsal surface to its mouth, * * * so that mere posture is no insufficient evidence of an unhealthy condition. The color changes to yellow, passing on by degrees toward a pale brown, whilst the skin becomes flaccid and opaque; death soon occurs, when the body, now shrunken by evaporation, lies on the lower side of the cell, increasing in depth of tone, until in a few days nothing more than a nearly black scale remains. Should the larvæ, however, escape contamination until nearly the period of pupahood, they are scaled over in the normal way by a cover made of pollen-grains and wax, * * * and which is pervious to air. The cover furnishes a screen, on which part of the cocoon is soon after spread, but the inhabitant of the cell is marked out for death, and before very long the capping or sealing sinks and becomes concave, and in it punctures of an irregular character appear, * * * and this is a nearly conclusive sign of the diseased condition of the colony. The sense of smell is also appealed to, as a peculiar, very offensive, and extremely characteristic odor now escapes from the diseased combs. The bees, in addition, lose energy, but become unusually active in ventilating their hive by standing at the door, heads toward home, and flapping their wings persistently so that a strong outcurrent, and as a necessary consequence, a corresponding indraught are set up. Should any attempt be made at removing a dead larva which has assumed a deep brown tint, its body tenaciously adhering to the cell wall will stretch out into long and thin strings like half-dried glue. The microscopist can easily explain this. The thin chitinous aerating sacs and tracheæ do not undergo decomposition at all easily, and these remaining, occasion the peculiarity referred to. * * * The disease is terribly infectious, and once started soon spreads from cell to cell and not unfrequently from stock to stock.

Mr. Cheshire was doubtless quite familiar with the disease of the brood and this description of the symptoms, we may assume, was not made from any one case, but from his entire experience. At that time two diseases of the brood were not recognized. We are justified in concluding that both diseases existed in England at that time, as they do now, and doubtless Mr. Cheshire had seen both without realizing that he was dealing with two distinct maladies. In this description he speaks of the disease as attacking brood at various times, for he says: "Should the larva, however, escape contamination until nearly the period of pupahood," etc. His description before that sentence applies as well to what we now call European foul brood as to American foul brood, while the latter description, especially where he speaks of the odor and ropiness, is undoubtedly drawn from experience with what we now call American foul brood. There is, at any rate, ground for the supposition that Mr. Cheshire was dealing with two diseases.

In the case of Mr. Cheyne, however, the case was entirely different. He was probably not familiar with the brood disease from practical experience. He also probably did all his work from one specimen, for he says: "On August 11, 1884, Mr. Cheshire brought to me a piece of comb containing larvæ affected with foul brood, with which I performed the following experiments." In describing this specimen he says: "These larvæ were dead, of a yellowish color, and almost liquid." This description certainly applies as well to European foul brood. Since the original description of *Bacillus alvei* is so important in this work, it may be well to quote entire Mr. Cheyne's part of this paper. This is practically unavailable to bee keepers, since it is contained in a journal to which few bee-keepers can have access. It is as follows:

> On August 11th, 1884, Mr. Cheshire brought to me a piece of comb containing larvæ affected with foul brood, with which I performed the following experiments: Selecting cells which were closed, but which Mr. Cheshire thought contained diseased larvæ, I brushed them over with a watery solution of bichloride of mercury (1: 1000) to destroy the organisms on the outside. With several forceps, that had been heated and allowed to cool, the covering of the cell was picked off so as to display the diseased larvæ. These larvæ were dead, of a yellowish color, and almost liquid, and on examination afterwards their juices were found to contain numerous moving bacilli. By means of a heated platinum wire, tubes of meat infusion rendered solid by gelatin (10 per cent), or by Japanese isinglass, were inoculated from several of these larvæ and kept at a suitable temperature. Development of bacilli, microscopically similar to those seen in the juices of the larvæ, occurred. The characteristics of this development will be presently described. Further, in the tubes, kept at the body temperature, there was not only a development of bacilli but also of spores.
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> These bacilli, as seen in the larval juices, measure about 1-7000th inch in length and 1-20500th inch in breadth. They are rounded or slightly tapering at their ends and often have a clear space near one end. In the juices of the larvæ during life they apparently do not produce spores, although after death spores abound.
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> In the cultivation in the peptonized meat infusion, rendered solid by agar-agar, the bacilli vary considerably in size, their average length being 1-7260th inch, some being as small as 1-10000th inch, and others as large as 1-5000th inch. When they have attained the latter size, division of the rod seems to begin. They are always somewhat pointed at their ends. Their average breadth is 1-30000th inch, varying from 1-35000th to 1-25000th.
>
> The spores are largish oval bodies, averaging in length 1-12000th inch (varying from 1-13100th to 1-10200th inch), and in breadth 1-23700th inch (varying from 1-24000th to 1-25000th inch).
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> In the agar-agar material the spores are generally arranged side by side in long rows, and in old cultivations only a few bacilli can be seen, some forming

spores, some without any indication of spores. That these small bacilli can produce such large spores seems at first glance at a microscopical specimen almost inconceivable, but I have been able to trace on the one hand the development of the spores in the rods, and on the other the sprouting of the spores into adult bacilli. This can be done in the following very simple manner:

Take a number of glass slides, each having a moderate-sized cell hollowed out in its middle; clean it and pass through a Bunson flame several times to destroy any bacteria on its surface. With a brush apply a little vaseline around the depression, and then place the slide under a glass shade to keep it from the dust. Clean a number of cover glasses, purify them in the flame, and place them on a pure glass plate beneath another shade. With a fine, pure pipette put a small drop of sterilized cultivating fluid (meat infusion with peptone) on the center of each of these cover glasses; then with a fine platinum wire inoculate each of the drops with the spores, or with nonspore-bearing bacilli; rapidly invert them over the cell, press down the cover glass so as to diffuse the vaseline around its edge, and place the slides in an incubator kept at the temperature of the body. These slides are removed at different intervals of time, and as soon as each is taken out the cover glass is turned over and the drop of fluid rapidly dried. The specimen can then be stained, mounted in Canada balsam, and studied at leisure. This method seems to me to be much more satisfactory than the observation of the organisms swimming about in the drop of fluid, while the specimens can be kept permanently and compared with one another.

In order to study the growth of the spores, I used a cultivation on the agar-agar cultivating material which had been kept at the temperature of the body for fourteen days, and which consisted almost entirely of spores, though a few bacilli were present. As the result of several experiments, I have got a series of preparations which have been taken at various times (15 minutes, 30 minutes, 40 minutes, 1 hour, 1½ hours, 1 hour 50 minutes, 2 hours, 2 hours 20 minutes, 2 hours 50 minutes, 2 hours 55 minutes, 3 hours 20 minutes, 4 hours 20 minutes, 5 hours, 5 hours 35 minutes, 5 hours 40 minutes, and 7 hours 50 minutes), and the course of events is shown in Plate X.[1] The bacilli stain with various anilin dyes—best, I think, with methyl-violet; but the spores resemble the spores of other bacteria in not taking on the stain. The cover glasses on which the organisms are dried are passed three times through the gas flame and floated on the surface of a fairly strong watery solution of methyl-violet for one or two hours. They are then washed in water, and afterwards laid in weak acetic acid (1 per cent) till no more stain comes out. They are again washed in water, allowed to dry at the ordinary temperature, and mounted in Canada balsam. A spore-bearing cultivation shows the bacilli stained violet and the spores unstained, with the exception of their outline, which is of a faint violet color. In most cases no trace of the rod in which the spore was formed can be seen. The first change which is observed on cultivation is that in many cases the outline of the rod in which the spore was formed becomes faintly visible. This can be seen in 15 minutes, and is, I think, simply due to swelling by the fluid, as it is also evident to some extent in the case of spores soaked in water for the same length of time. In from half an hour to an hour it is evident that the bacilli which were present in the original material are beginning to multiply, and a considerable number of rods are now seen containing spores. It is evident that these spores are newly formed, as extremely few bacilli containing spores were seen in the original material, whereas in the preparations taken from a half hour to an hour a considerable number are present. That some of the rods, instead of growing by fission, at once proceed to form spores is probably to be explained in this way. When the cultivation was removed from the incubator, some bacilli were growing by fission, some were forming spores, and some had passed into a state ready to form spores. The first go on growing by fission, the last complete their spore-formation, which was arrested by removal from the warm temperature. That actively growing rods would not have formed spores so early is evidenced by the facts observed in the second series of observations on the formation of spores. The next thing that is observed is that several of the spores take on the stain, and are as intensely violet as the adult bacilli. The number of the spores which take on the stain in this way goes on increasing as time passes, till in about four hours almost all the spores stain violet. In three hours the first indication of sprouting of these spores becomes evident.

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[1] Not reproduced here.

The stained part of the spore loses its oval shape, becomes elongated, and is soon seen to burst through the spore-capsule at one part. It then presents the appearance of a short rod, with a pale envelope embracing one end. This rod gradually leaves the spore-capsule and then goes on multiplying as a full-grown bacillus. In specimens taken from four to five hours all stages of growth can be seen, and the remains of the ruptured spore-capsules are evident.

The bacilli appear to grow mainly by fission, but I have seen appearances which seem to me only explicable on the supposition that they also grow by sending out buds from one end. A bacillus may be seen with a small, somewhat conical stained point attached to one end, though separated by a marked division. This is certainly not the common mode of growth by fission, for there the rod seems to divide into two pretty equal halves, while here we have but a minute piece attached to one end.

The mode of formation of spores may be traced in a similar manner to that described above in the case of the sprouting of the spores. It is, however, as a rule, necessary to leave the organisms to grow for a much longer time than in the former instance. I have not found development of spores as a rule before twenty-three hours, but this depends very much, apparently, on the amount of fluid that was present and the number of bacilli introduced at the time of inoculation. The first thing noticeable is that the rod begins to swell and becomes spindle shaped. The swelling, which generally affects the middle of the rod, may in some cases be most marked toward one end, increases in size, and the center of the swelling gradually ceases to take on the stain. The capsule of the spore is apparently also formed within the rod, and is not merely the outer part of the rod. In three or four hours the rod is seen to have almost or completely disappeared, leaving the spore lying free or within the faint outline of the original bacillus. It seems to me that the view that spore formation occurs when the food is getting exhausted is correct, for the time at which this appearance is found depends greatly on the drop placed on the cover glasses, and I have found in one experiment that in one specimen, after twenty-three hours, most of the rods were forming spores, while in another specimen where the drop was much larger there was no trace of spore formation after twenty-eight hours. I have here described the results of my earlier and rougher attempts to study the formation of spores. I have, however, now improved the method in the following way. As I have just now shown, the period at which spores are first seen seems to depend mainly on the amount of fluid used and the number of bacilli introduced, and as in the above method, both these factors vary in each case, one can not get a regular series of preparations showing the different stages at different times. In studying the sprouting of spores the amount of fluid and the number of spores does not matter, for if sufficient nutriment is present and a proper temperature is maintained the spores must sprout, and probably they always take about the same length of time. The difficulty of obtaining a series of specimens illustrating spore formation is easily obviated in the following manner. Take a pure flask containing a small quantity of sterilized infusion and inoculate it from a cultivation containing only bacilli. Place it in the incubator for two or three hours so that the bacilli may increase somewhat in number and diffuse themselves through the liquid. Thus the cultivating material contains bacilli pretty equally diffused through it, and if after shaking the flask drops of equal size are taken, each will probably contain about the same number of bacilli. The minutest quantity of fluid can easily be obtained by means of a syringe having a fine screw on its piston and a large nut revolving on this screw. The circumference of the nut being equally divided into a number of small segments, the same quantity of fluid can always be expelled from the syringe. By proceeding in this way equal-sized drops containing an equal number of bacilli can be used and a regular series of specimens obtained. I have found that using two-fifths of a minim containing one bacillus and keeping the specimen at 36° C., the earliese appearance of spore formation was evident in forty-one hours.

Leaving these matters, which are of great interest not only in regard to the *Bacillus alvei*, but to all spore-bearing bacteria, and which I have therefore dwelt on at length, we must pass on to the further consideration of this particular organism. The first point to be determined in investigating its relation to foul brood was whether this was a new bacillus, unknown except in connection with this disease or bees, or whether it was a more or less well-known form. To ascertain this point with regard to micro-organisms the microscope is of little use: recourse must be had to the study of their life history, more especially to their peculiarities of growth on different soils. Of all the materials employed as cultivating media, Koch's gelatinized meat infusion is the most useful for purposes of diagnosis. This is composed of an infusion of meat containing 1 to 3 per cent of pepton, 10 per cent gelatin, made neutral by carbonate of soda, and thoroughly sterilized. This material was first introduced with the view of having a highly nutritive solid and at the same time transparent medium on which to carry on pure cultivations, but it was soon found that owing to the remarkably diverse ways in which different micro-organisms grew in it, it could be used as a means of diagnosis of the kind of organism, a means more certain than any other which we at present possess. For purposes of diagnosis, as well as with the view of carrying on pure cultivation, this material is used in three ways. While the material is still fluid a small portion is poured into a number of pure tubes plugged with cotton wood, sterilized, and allowed to solidify. A fine platinum wire, heated in a flame and allowed to cool, is dipped into the material containing the bacterium in question, and then, after the removal of the cotton-wool plug, is rapidly plunged down through the gelatin to the bottom of the tube and then withdrawn. The plug is reinserted and the tube kept at a temperature suitable for the development of most forms of bacteria, but not high enough to melt the gelatin. If growth takes place at this temperature it occurs either on the surface around the point of entrance of the needle, or along the needle track, or in both places, and the appearance of the growth varies remarkably, according to the different species of micro-organisms studied. The second way is to liquefy and pour out a little of the gelatinized material on microscopic slides or on larger plates of glass which have been sterilized by heat. These plates are placed in glass vessels containing moist blotting paper to prevent drying of the gelatin and to protect them from the dust. After the gelatin has solidified the purified platinum needle charged with the bacteria is drawn rapidly over the surface of the gelatin. Bacteria are sown along the track, grow there, and the whole can be placed under a microscope and the characteristics of the growth studied with a low power. In the third mode a tube of the gelatin mixture is inoculated with a very minute quantity of the bacteria. The tube is then placed in water at the body temperature to melt the gelatin. When the material is melted, it is thoroughly shaken up to diffuse the bacteria through it and, while still liquid, is poured out on sterilized glass plates kept in a moist chamber, as in the former case. Solidification very soon occurs, and the bacteria being caught at various parts of the gelatin grow there in the form of groups or colonies, which can be observed under the low power of the microscope. I shall now describe the characteristics of the *Bacillus alvei* when cultivated in these three modes.

(*a*) *Test-tube cultivations.*—If an infected needle be plunged into a tube of gelatinized meat infusion in the manner described above, growth occurs both on the surface and along the needle track. On the surface the bacilli shoot out in all directions from the point of entrance of the needle, forming a delicate ramifying growth on the top of the gelatin; the characteristics of this growth will be presently described under *b*. Along the track whitish irregular shaped masses appear, which slowly increase in size and run together. In a few days processes are seen to shoot out from these masses, which may extend through the gelatin for long distances from the track, being thickened at various parts and clubbed at the ends. These processes do not appear to join one another at their ends. A very beautiful and characteristic appearance is got where very few bacilli are introduced with the needle and where, therefore, at various parts of the track, more especially at the lower part, individual bacilli or groups of bacilli are planted at a considerable distance from each other. In a few days minute round whitish specks become visible to the naked eye. These increase in size till in about ten days shoots begin to appear. These radiate from the central mass in all directions and become nodular at various parts, as described above. When such a cultivation is old, the white branches disappear, and only little whitish collections of bacilli are seen at various parts. On examining such a tube with the pocket lens, however, numerous watery-looking tracts are seen running through the gelatin from the central mass to the whitish collections. The gelatin at the upper part of the track generally evaporates, to some extent giving rise to the air-bubble appearance so characteristic of the cholera bacillus. These are the appearances seen where the material contains gelatin in the proportion of 10 per cent. Where less gelatin is present, the naked eye appearances, while possessing the same characteristics, are somewhat different. The shoots are much more numerous and appear much more rapidly, giving rise to a haziness around the middle track, which with the pocket lens is seen to consist of numerous delicate branches clubbed at the ends, as in the former case. I think the amount of pepton present also makes a difference in the appearance, though of this point I am not yet absolutely certain. The most characteristic growth is, however, obtained when the material contains 3 per cent pepton as well as 10 per cent. gelatin, the shoots being then less numerous and much coarser. And I can easily understand that this would be the case, for the bacilli would have a large supply of nutriment in their immediate vicinity without the necessity of having, so to speak, to spread out through the gelatin in search of food as may be the case where no pepton, or only a small amount, is present. This appearance is quite characteristic of this bacillus and is not seen in the cultivation of any other organism that I know of. The bacilli of anthrax and of mouse septicæmia also spread out from the needle track, but the appearance of their cultivation is quite different. In anthrax delicate threads, not clubbed, shoot out from the track, soon anastomosing with other threads and forming a delicate network throughout the gelatin. In mouse septicæmia the appearance is that of a delicate cloudiness spreading through the gelatin. These foul-brood bacilli, growing in this material, render it liquid after a time, the liquefaction beginning at the surface and only spreading slowly downwards, but ultimately the whole tube becomes liquid. After two or three weeks' growth the appearance presented by the tube is that of a layer of liquid at the upper part, and the growth along the needle track with the other appearances described at the lower part. The liquid portion is clear, except at the bottom of the liquid, where there is a loose white flocculent deposit of bacilli, and on the surface there may be a very thin scum. The liquid becomes yellowish in color after a time and gives off an odor of stale but not ammoniacal urine, or what may be better described as a shrimpy smell. This yellowish color and the peculiar odor have been found by Mr. Cheshire to be distinctive of the diseased larvæ.

(*b*) If gelatin be poured out on a plate, allowed to solidify, and then stroked with an infected needle, we learn the explanation of the appearances seen in the test-tube cultivations. The bacilli at first grow along the needle track, but very soon they are seen to be collecting at parts forming pointed processes. From the processes the bacilli grow out into the gelatin, often a single series of rods, in Indian file, or two or three rods side by side. These processes are not quite straight, but tend to curve, and at a little distance from the track they grow round so as to form a circle. From this circle, which may be formed of single bacilli, the process continues forming a fresh circle farther on. The bacilli in the circle increase in number till ultimately it becomes completely filled up, and we have a nodule consisting of bacilli in the course of the shoot. These shoots may also join one another, forming a curved anastomosis, and the gelatin in the immediate vicinity of the bacilli becoming liquid, a series of channels are formed in the gelatin containing fluid in which the bacilli swim backwards and forwards. Later on parts of these channels become apparently deserted by the bacilli, so that the circles look to the naked eye as if they were detached from the main track, but with a low power of the microscope the empty channels can be traced.

It is impossible to give a proper idea of the appearance of the growth. The forms assumed are the most beautiful shapes I have ever seen, but they are very numerous, always, however, retaining the tendency to form curves and circles; thus we have the explanation of the appearances previously described in the test-tube cultivations.

(*c*) The appearances of the colonies on plates on which the mixture of bacilli and gelatinized infusion has been poured out is also very characteristic. The earliest appearances of colonies is a small oval or round group of bacilli. This group is not homogeneous in appearance under a low power of the microscope, but lines indicating the bacilli are seen in it. It very soon becomes pear-shaped, and from the sharp end of the pear processes begin to pass out into the gelatin as before described.

These bacilli do not grow below 16° C. The best growth in gelatin is obtained at a temperature of about 20° C. They grow most rapidly in cultivating materials kept at the body temperature. Very few spores are formed at the lower temperatures, but they appear rapidly and in large numbers at the body temperture. I have several times observed bacilli containing spores swimming about freely. The reaction of the medium is not of any great importance, but a neutral medium is apparently the best. The bacilli swim freely in fluids with a slow oscillating movement.

They grow rapidly at the body temperature in meat infusion with pepton and rendered solid by agar-agar, but the appearance of their growth is not

> nearly so characteristic as in gelatin. This, indeed, is the case with most bacteria, so that agar-agar preparations, though very useful for carrying on pure cultivations at the temperature of the body, are of little value for diagnostic purposes. They grow most rapidly on the surface of the agar-agar, forming a whitish layer, but the shoots described above in the case of gelatin do not occur, or only very imperfectly, in agar-agar. Here the bacilli arrange themselves apparently side by side, and, producing spores in this position, we have as a result, after a few days' cultivation, long rows of spores lying side by side with here and there an adult bacillus.
>
> On potatoes they grow slowly, forming a dryish yellow layer on the surface. They grow very slowly indeed at the lower temperature. In order to get good growth it is necessary to keep the potato at the body temperature.
>
> In milk they grow well at the body temperature, and in a few days cease coagulation of the milk, which also assumes a yellowish color and gives off the odor previously described. The coagulum is not firm, like that caused by the *Bacterium lactis,* but is like a tremulous jelly, and may remain for a considerable time without the separation of any fluid, but ultimately it becomes liquid, and after some months assumes the appearance of a dirty, brownish-yellow, glairy fluid. It is very slightly, if indeed at all, acid.
>
> They grow extremely slowly in coagulated blood serum, though kept at the body temperature, and there form very long filaments with comparatively few spores.
>
> In meat infusion kept at the temperature of the body they grow readily, causing muddiness, and after a few days a slight but not tenacious scum. The same peculiar odor is also developed here, more especially if the infusion contains a considerable amount of petone. I do not think that there is any change in the reaction of the fluid; I generally make the infusions faintly alkaline, and after the growth of this organism in it is faintly alkaline.
>
> These characteristics show that this is a new bacillus, and one which, so far as my knowledge and experience goes, is only found in foul brood. The constant presence in large numbers of a characteristic organism in a disease and its absence elsewhere must, according to our accumulating experience, afford a strong presumption that the organism is the cause of the disease. In the case of foul brood this matter has been completely proved by the following experiments, the details of which will be found in Mr. Cheshire's part of this paper. With a cultivation in milk he sprayed a comb containing a healthy brood, allowing the spray to act only on a particular part of the comb. This part and no other became affected with foul brood. He has also succeeded in infecting adult bees by feeding them with material containing these cultivated bacilli.
>
> I have also had the opportunity of watching the effect of feeding flies with material containing spores and bacilli. I was one day testing some milk in which these bacilli were growing; a large blue-bottle fly settled on it and commenced to eat. I at once put a large glass funnel over the insect, leaving plenty of air. When I came to the laboratory twenty-four hours later, the fly was in the sitting posture on the table and was dead. Its juices were full of these bacilli, as shown by microscopical examination and by cultivation.
>
> Other animals which I have tested are more or less refractory to this bacillus. I have kept cockroaches for days in a box in which was milk containing these bacilli mixed up with sugar. I have also kept them in a box containing a piece of paper which had been thoroughly smeared with the spores. None of them died, but I can not be certain that in either case they ate any of the material, for I never saw them even near it.
>
> I inoculated two mice and one rabbit with a spore-bearing cultivation without effect.
>
> I injected half a syringeful of a spore-bearing cultivation into the dorsal subcutaneous tissue of each of two mice. One of these died in twenty-three hours, the other seemed unaffected, but in the second case I doubt whether the full quantity was introduced. In the case of the mouse which died, the seat of injection and the neighboring cellular tissue was found to be very œdematous, but no microscopic changes were apparent in the internal organs. Numerous bacilli were found in the œdematous fluid, as also a number of spores which had not been sprouted, and there were also a few bacilli in the blood taken from the heart. This was proved, of course, by cultivation as well as by microscopical examination. On examining sections of the various organs no morbid changes were found, and only very few bacilli were seen in the blood vessels.

> At the same time that I injected the mice I injected a syringeful of the same cultivation subcutaneously into a guinea pig. This animal died six days later with extensive necrosis of the muscular tissue and skin and cheesy-looking patches distributed through it. There was no true pus. On making sections of the necrosed tissue numerous bacilli, apparently *Bacillus alvei,* were seen, but there were other bacteria and also micrococci, as of course would be the case on account of the death of the skin. No micro-organisms were seen in the internal organs. It thus remains questionable whether the necrosis was due to the *Bacillus alvei* or not, more especially as I have since injected three guinea pigs subcutaneously with spore-bearing cultivations, but without effect. I must reserve the action of these bacilli on the higher animals for further investigation, as well as several other points of interest in regard to this organism of which I have not here alluded.
>
> I venture to think that when all the evidence brought forward by Mr. Cheshire and myself is carefully weighed no doubt can be entertained that this bacillus is new to science and is the cause of foul brood. Many questions of course still remain open, requiring further investigation into the life history of the disease.

The next investigator to take up a bacteriological treatment of bee diseases was Prof. J. J. Mackenzie, bacteriologist of the provincial board of health of Ontario. The results of this work were published in the Ontario Agricultural College Report for 1892, pages 267-273. At the request of the Bee Keepers' Union of Canada certain things were taken up which had a very practical bearing on the question of eradicating the prevalent disease.

Professor Mackenzie knew of but one disease, probably, and having in hand the work of Cheshire and Cheyne, assumed that the disease found in Canada is the same as that described by Cheyne. This is a natural mistake after the confusion in the diagnosis by Cheshire. It was not the object of this investigation to demonstrate what organism produces the diseased condition, but, assuming that *Bacillus alvei* causes the trouble, to determine what resistance to heat the organism has.

No adequate description, such as would allow us to make any comparisons with *Bacillus alvei,* is included in Professor Mackenzie's paper. We do know, however, or at least have every reason to believe, that European foul brood was not found in Canada at that time and is not prevalent there now. I have been informed personally by Mr. William McEvoy, the veteran inspector of Ontario, that the disease which we now designate as American foul brood is the prevailing disease in Canada. It seems reasonable to suppose, therefore, that the samples taken to Professor Mackenzie by Mr. Holtermann and others did not contain any *Bacillus alvei.*

Professor Mackenzie does not indicate in his paper that he had any difficulty in getting the organism with which he worked to grow on ordinary media. *Bacillus larvae,* which is present in American foul brood, does not grow in such media, however, so there is but one conclusion to be reached, and that is that he was dealing with some nonpathogenic form and not with *Bacillus larvae.* Since the bacillus described by Doctor White as *Bacillus A* is found on combs, both diseased and healthy, and somewhat resembles *Bacillus alvei,* it may be that this is what Professor Mackenzie had.

This paper has probably come to the notice of but few bee keepers in the United States, because the report of the agricultural college is not widely distributed. To make it available for comparison, therefore, it is included here.

## THE FOUL BROOD BACILLUS (B. A.VEI); ITS VITALITY AND DEVELOPMENT.

[From Ontario Agricultural College Report for 1892, pp. 267-273.]

Mr. J. J. Mackenzie, B. A., bacteriologist of the provincial board of health of Ontario, read the following paper:

GENTLEMEN: At the request of your secretary, Mr. Holtermann, I undertook for your union some investigations on the subject of foul brood, the results of which I propose giving you in this paper. Although it is almost a year now since I undertook this work under the auspices of the Agricultural and Experimental Union, it is by no means exhausted, and there are many points which require to be further elucidated, which I have not had time as yet to touch on, owing to the fact that investigations on foul brood had to be carried on simultaneously with my regular laboratory work. These points I hope to work at next summer, and reserve the privilege of reporting again to your union on the results of further investigation.

The subject of foul brood is an old one to apiarists and an intensely interesting one to Canadian bee keepers, but in reading over the bee journals one can not help being struck with the great want of unanimity amongst bee men as to the disease, how it should be treated, how it is spread, and on many other points. Some would have us believe that the disease arises de novo whenever insanitary conditions prevail; others claim that there is a specific infection and where the disease arises it must have originated from previously existing disease; some claim that the honey is the only method of transmittal; others that it is not, and so on. On every point there seems to be plenty of argument pro and con.

I have attempted in my work to take hold of some of these controverted points from a bacteriological standpoint in order to aid in coming to some definite conclusion. Some of these points I should consider settled from the results of previous investigation; but as many bee men do not seem prepared to accept this, my work will have value as confirming what has already been done.

Before an association which includes many practical bee keepers it would be superfluous to enter upon a minute account of the clinical features of the disease. Most of you know them better than I do. I certainly would not be prepared to ''spot'' foul brood in an apiary, although I certainly think I can under the microscope. The infectious character of the disease has been generally accepted for many years, but not until Cheshire and Watson Cheyne worked it out scientifically was it definitely proved. They isolated a bacillus (***Bacillus alvei***) which they found in the diseased brood and which they cultivated on nutrient media for many generations, finally reinfecting perfectly healthy brood from these pure cultures. This evidence to a bacteriologist is absolutely conclusive that *Bacillus alvei* is the specific cause of foul brood. Consequently, when I began my investigations on some samples of diseased brood which were sent me through Mr. Holtermann, I looked at once for *Bacillus alvei.* Microscopically and by means of bacteriological methods I had no difficulty in isolating a bacillus which corresponds in all points to *Bacillus alvei.* It is a bacillus similar to that of Cheshire's in size, produces spores which are somewhat thicker, giving the bacillus a clubbed appearance. On agar jelly it grows rapidly so as to cover the whole surface. In gelatin its growth is very peculiar, shooting out from the infected point in all directions. On potatoes it produces a yellow growth. All these characters show conclusively that it is identical with *Bacillus alvei.* There seems no doubt, therefore, that the foul brood which we have in Ontario is the same disease and produced by the same bacillus as in other places.

Many prominent bee keepers, both here and in the States, however, maintain that wherever unsanitary conditions are allowed to prevail, wherever chilled brood is allowed to putrefy, or decapitated drones are left to decay in the hive foul brood may arise de novo. This is not a new theory, either in bee keeping or in medicine, but unfortunately it is a theory which is not supported by the results of investigation. Diphtheria naturally will develop more readily if unsanitary conditions are present, but it certainly will not develop if the *Baccillus diphtheriae* is absent. The same is true of other diseases, and consequently when we come to consider such a decidedly infectious disease as foul brood and learn the facts about it which such men as Cheshire have told us we naturally come to the same conclusion. If I were to maintain that a Carniolan queen might lay an egg which would develop into a humble bee, bee men would be inclined to think that not only my bee knowledge, but also my scientific knowledge, was at fault; but yet in all the bee journals I find many prominent bee keepers maintaining that an ordinary microbe which produces putrefaction may become metamorphosed into the specific cause of foul brood. It is easy enough, however, to combat such an opinion upon a priori grounds, but not quite so easy to offer convincing proof.

In order to do this I thought it worth while to try some experiments. With this end in view I obtained some comb containing chilled brood and endeavored to isolate *Bacillus alvei* from it, but without success.

There were plenty of other bacteria, but none which presented the well-marked morphological characters peculiar to *Bacillus alvei.* Again I had sent to the laboratory a piece of perfectly healthy comb. I killed the brood by chilling. Then I infected some of the cells from a pure culture of *Bacillus alvei.* I allowed all the chilled brood to putrefy in a moist chamber for two weeks, at the end of which time I obtained *Bacillus alvei* again from the cells which had been artificially infected, but could find no traces of it in the other cells. I left this comb in a moist chamber for several months and again examined, but with the same results. In the cells in which *Bacillus alvei* had been placed it was still to be found; in the others it was not present.

It seems to me that an experiment such as the above conclusively shows that there is a distinct difference between foul brood and ordinary putrefaction.

In considering the subject of the vitality of *Bacillus alvei* the first question which naturally arises is its power to resist heat. We know that bacilli which produce spores and those which do not stand in entirely different positions in this regard. The sporeless bacillus is destroyed at a much lower temperature than one which contains spores. Consequently in considering the question of the vitality of *Bacillus alvei,* which produces spores very quickly and easily, we may confine our attention entirely to the vitality of the spore.

This is of special interest, as the question has been repeatedly raised whether it is dangerous to use comb foundation made from foul-broody wax. Does the temperature to which the wax is raised in the manufacture of comb foundation sufficiently destroy the vitality of the spore? Can the spore germinate and infect the brood when once inclosed in the wax?

These questions have been raised by many careful thinkers among bee men, and certainly deserve attention. The second point ought to be considered first, since if surrounding a spore with a film of wax prevents its germination, we need pay no further attention to the question of heat. The crucial test of this would naturally be, supply a healthy colony with comb foundation known to contain the spores and observe the result. This I had hoped to try with the assistance of your secretary, but other work came up which interfered with the carrying out of the experiment and consequently it had to be postponed until next year. However, I was able to perform one experiment which throws some light on the subject. Mr. Holtermann, the secretary of your union, sent me several pounds of very fine wax, such as is used for the manufacture of comb foundation. I cultivated the *Bacillus alvei* upon agar jelly until I had a large quantity of the bacilli containing spores; this was carefully scraped off the jelly and dried first in the air and then over sulphuric acid. The resulting grayish mass was pulverized with a sterilized pestle and mortar, and finally mixed thoroughly with the melted wax kept at a temperature sufficiently low to prevent the immediate destruction of the spores by heat. By this means an enormous number of spores were introduced into the wax. After stirring the wax for some time in order to insure a proper mixing it was allowed to cool. This, as you all know, takes some time when dealing with a considerable quantity. During the cooling I was careful not to disturb the wax.

After it had solidified I set out to discover if I could again obtain my bacillus from the infected wax. If it would germinate in the nutrient media, it certainly would in the bees, and that point was to a certain extent settled. Now I obtained the following results:

From the upper layers of the infected wax I was unable to obtain cultures of the *Bacillus alvei,* either by melting the wax in the nutrient jellies or by allowing particles of the unmelted wax to fall on the surface of these jellies.

From the under layers, however, the results were different; particles of wax placed on nutrient agar in an oven kept at 98° F., became surrounded in twenty-four hours with a luxuriant growth of *Bacillus alvei.* When the wax was melted into the agar or into the beef tea, I also obtained the bacillus, consequently it looks as if the mere fact of enveloping the spores with a film of wax was not sufficient to prevent germination. I confess I cannot understand how a spore could germinate when surrounded with a film of wax. Spores in germinating require moisture, and if a spore is completely embedded in wax, it can not obtain sufficient moisture to germinate; I would rather believe, therefore, that in this particular experiment the spores had not each an envelope of wax, but that many of them were partially free from wax. Now, if this was the case in my experiment, where I endeavored to make the incorporation of the spores in the wax as thorough as possible, I certainly think it may frequently be the case when foul-broody wax is used and no particular precaution taken. That even when spores are thoroughly surrounded by wax they may not be freed occasionally by the workers is a point which requires further elucidation and upon which I intend to try some experiments next year.

In looking through the bee journals, however, I find it everywhere maintained by foundation makers that they never knew of a case of foul brood originating from foul-broody wax; and I have yet to discover a well-authenticated case where this has occurred. What explanation can we offer of this widespread opinion?

I explained to you above that I was unable to cultivate *Bacillus alvei* from the upper layer of the infected wax. Your secretary also sent me a small specimen of wax which he stated he knew to be from foul-broody comb. This I examined repeatedly for foul brood, but was able to obtain it only once. I think we must look to the physical conditions for an explanation of the freedom from infection through comb foundation. The difference in the specific gravity of the bacteria and of melted wax is so great that throughout the process of manufacture the bacteria tend to fall to the bottom. The first refining of the wax must, of course, remove the greater quantity, and the vast majority of the remainder will settle to the bottom during the process of foundation manufacture. But that the simple process of mixing the infected material with the melted wax is not sufficient to prevent germination I think is shown by the results quoted above, where simple fragments of infected wax when placed on agar jelly gave rise to a culture of *Bacillus alvei*.

This question I hope to touch on again after I have had an opportunity of supplying healthy bees with foundation made from infected wax.

The other question is whether the temperature to which wax is raised during foundation making is sufficiently high to destroy the spores of foul brood. In order to decide this question there are several points to be noted. The first is the character of the heat. We know that moist heat will destroy bacteria and their spores much more quickly than dry heat, and Mr. Corneil, of Lindsay, has raised this point several times, claiming that the heat to which the bacteria are exposed in melting wax is not moist heat but dry heat, consequently we must heat to a high temperature and for a long time in order to destroy the spores. The point is undoubtedly well taken, and can only be settled by direct experiment. In order to determine the temperature at which the spores are destroyed in melted wax, I used a method that was first described by Koch. Sterilized silk threads were saturated with a beef-tea culture of *Bacillus alvei* in which there were large numbers of spores. These threads were then allowed to dry and in the dry state were preserved. These dried threads were introduced into the melted wax and allowed to remain in it for a definite time at a fixed temperature. At the end of that time the thread was introduced into the melted agar or into beef tea heated to the melting point of wax, and thoroughly shaken, so as to separate the wax as much as possible from the threads; then the culture medium was rapidly cooled, and the tubes placed in the ordinary cultivating oven kept at 98° F. If I obtained a growth of bacilli, I concluded that the threads had not been sufficiently heated in the wax; if I did not, I concluded that they had been sufficiently heated. The following are my results:

At 212° F. (100 C.):
- For one-quarter of an hour: Growth.
- For one-half an hour: Growth.
- For one hour: Growth.
- For one hour and a half: Growth.
- For two hours: Growth.
- For two hours and a half: No growth.

At 194° F. (90° C.):
- For one-half hour: Growth.
- For one hour: Growth.
- For two hours: Growth.
- For three hours: No growth.
- For four hours: No growth.

On the other hand, a temperature of 122° F. (50° C.) did not destroy the spores in twenty-four hours.

I have repeated these experiments several times with the same results, so that I would conclude that to destroy the foul brood in wax it is necessary to heat to a temperature of at least 194° F. for at least three hours. Now the question arises, does this take place during the process of manufacture of comb foundation? In order to get as much data as possible on the subject I wrote to Mr. Larrabee, of Michigan Agricultural College, as he had kindly offered me any assistance in his power. He applied to two prominent foundation makers for information. From their replies it is apparent that, for a short time at any rate, during the refining and purifying of the wax it reaches a temperature quite at or near 212° F. During sheeting, however, it apparently does not reach a temperature much above the melting point, say 175° F. They both seemed to agree that steam heat for too long a time injures the quality of the wax.

In the American Bee Journal, 1891, page 470, we find some statements on the subject in a reply by two prominent foundation makers to an article by Mr. Corneil upon the dangers of infected comb foundation. One of them, Mr. Dadant, states that in refining it is heated for some time at 212° F. and is kept liquid for twenty-four hours. The other, Mr. M. H. Hunt, states that it is kept at the boiling point for six or seven hours. If these are the actual temperatures reached during foundation making, I am inclined to think there is little danger from foul brood in that direction.

I thought it possible that the whole question could be settled by introducing a certain amount of some disinfectant—say beta naphthol—into the melted wax, but my results have not been satisfactory. Apparently even the introduction of 1 per cent beta naphthol into wax did not hasten materially the destruction of the spores. I was able to demonstrate the presence of living spores in wax containing 1 per cent beta naphthol and heated for two hours to 194° F.

From all these facts, and taking into consideration also the physical fact of the settling of the bacilli to the bottom, I should think that with reasonable care in the preparation of comb foundation, the dangers of infecting from this source would be slight. But that the spores may germinate after being mixed with the wax, I think I have shown.

Why the spores of the *Bacillus alvei* are killed so quickly in the melted wax I am not able to explain, but it may be due to the fact that the wax itself when heated to such a temperature has an antiseptic value. That the spores resist other antiseptics as strongly as do the spores of anthrax I have proved by testing.

Cheshire and others recommend a solution of 2 per cent carbolic acid for disinfecting the hive after removing infected comb, but on actual experiment with the infected silk threads I have found that 2 per cent carbolic acid did not kill the spores in six days. These results are similar to those obtained by Koch for the spores of anthrax, and show that 2 per cent carbolic acid can not be relied on to destroy the spores. However, the question of the value of antiseptics I will take up more in detail later on in this paper.

I would like to say a word or two now on the methods of treating the disease. There are practically two methods: first, the starvation method; second, the method of medicated sirup. Mr. McEvoy's method of treatment, it seems to me, is practically a modification of the starvation method. The first method is widely used both here and in the United States, whilst in England and Europe generally the second method is adhered to.

Considering the vitality of the spores of foul brood, it would seem at first sight useless to try any process which did not recognize as its foundation the destruction of the germ. I find, however, that many prominent bee keepers who have had practical experience with the method of starvation, or Mr. McEvoy's method, accept it as successful. I have not had an opportunity to examine colonies which have been cured in this manner, and so can not say that the bacilli have disappeared. I hope next summer to test this question more fully. We may, however, examine into the rationale of the method. In conversation with Mr. Corneil, of Lindsay, he made a suggestion which may be quite familiar to you all, but which seems to me the only explanation. That suggestion was that either starvation or comb building carried the infected nurses past the period at which they act as nurses and gave them a chance to rid their intestines of the germ. If this is combined with a removal to absolutely clean hives, with new foundation, it may succeed, but I must say that absolute cleanliness in this respect must be insisted on.

As I said above, I have not had any opportunity of investigating the results of these methods practically, and so can not speak with certainty.

The fact of the presence of the bacilli in the workers and in the queen bears, to a certain extent, upon this question. Cheshire and others make the statement that the bacilli are found in the intestines of the workers and in the ovaries of the queens. My own experience confirms this. I have found them repeatedly in the workers, and in five queens from infected hives I succeeded in obtaining the bacillus from the ovaries of three. That they are not always present in the ovaries of the queens from diseased colonies is certain; their presence there is apparently accidental. For instance, in the case of one of last year's queens in a hive rather badly diseased I was unable to find the bacillus, whilst in a six weeks' queen from a hive in which there were only a few diseased cells I succeeded in finding it.

Cheshire's statement that he found a bacillus in an egg of an infected queen seems to me to require confirmation. I have not been able to find the eggs infected myself, but it is a question which would require very long and careful investigation before one could be able to deny or confirm such a statement.

In the second method of treatment by medication I do not think that an absolute destruction of the spores takes place, any more than in the starvation method. As I have shown above, 2 per cent carbolic acid was not sufficiently strong to destroy the spores, consequently it is not likely that 0.2 per cent (1 part in 500) would be strong enough. I tried 0.2 per cent, but found it quite unsuccessful. Its action then must have another explanation. To test this I made up a sterilized beef broth containing 1 per 500 of carbolic acid, and in it placed my infected silk threads. I found that there was no indication of growth. These threads were then taken out and placed in ordinary sterilized beef broth, and I obtained a luxuriant growth, i. e., the 0.2 per cent carbolic acid in the culture fluid, although it did not destroy the spores, prevented their germination. That, then, is the explanation of the value of carbolated sirup in the treatment of the foul brood, it prevents the germination of the spores. The bee journals contain numerous examples of cases where carbolated sirup produced an improvement, but as soon as it was stopped there was a relapse. It is evident that here again, as in the starvation process, there must be combined an extremely thorough cleaning up, so that the best possible results may be obtained from the treatment. Medicated sirup does not destroy the spores, it simply prevents their development and gives the bees a chance to rid themselves of the infection, and in that respect I certainly think resembles the starvation process. Its advantages over that is that it can be carried on for a longer time.

In the course of these experiments I tried another substance which has been much used since Lortet's work on the subject, viz, beta naphthol. I do not think myself, from recent work on this substance, that beta naphthol should be ranked very high as an antiseptic, mainly on account of its insolubility in water. I found, however, that a beef broth containing 1 per 1,000 beta naphthol would not allow spores of *Bacillus alvei* to germinate, and consequently had an equal value with 1 per 500 of carbolic acid. It has an advantage over carbolic acid on account of the disagreeable taste of the latter, and I think would be more acceptable to the bees.

Salicylic acid in sirup has apparently the same effect, but I would not recommend the addition of borax, as Behring has shown that borax lowers considerably the antiseptic value of salicylic acid.

I tested also formic acid in the same way, but my results so far have not been satisfactory, owing to the uncertain strength of my sample of formic acid. I prefer to reserve a report upon it and other substances which I wish to try until later.

Mercuric chloride I have not tested, as I do not think it wise to use it around the hive. The idea of using a 1 per 1,000 solution to spray the diseased combs, as suggested sometimes, is, I think, absurd, and would be a rather serious operation for any living brood.

You will see that I consider all these methods of treatment do not in themselves necessarily presuppose the destruction of the spores, but depend upon the fact that for a longer or shorter period the spores are prevented from germinating, and in this period they are eliminated from the infected bees. Whether the vitality of the bees themselves has an effect upon the elimination or destruction of the spores is a point which would be extremely interesting, but one on which at present we have no definite information. From the results of bacteriological work on other diseases we know that the animal body is engaged in a constant warfare with the disease germs which may be introduced, and this also may be the case in foul brood. Much more extended investigations, however, would be necessary to prove this. It is much safer for apiarists to accept the possibility of a recurrence of the disease after a course of treatment, owing to the lodgment somewhere of some of the spores of *Bacillus alvei*, and by care and cleanliness remove this possibility. To do this the hives and frames in which a foul broody colony has lived must be sterilized, and this may be done in various ways. For the sterilization of material by disinfectants there was a tendency formerly among bacteriologists to run to such disinfectants as corrosive sublimate, carbolic acid, etc., but later work has shown that there are a number of common chemicals which will act just as well, or perhaps better. Corrosive sublimate has lost much of its reputation as a disinfectant within the last few years, and carbolic has been shown to be not nearly so powerful as at first supposed.

For cleaning hives and frames which are suspected to contain the spores of foul brood a hot 10 per cent solution of soft soap is perhaps as effectual as any that can be recommended. A good strong solution of washing soda, when hot, is also very active, destroying the spores in a few minutes. Both these are certainly better than 5 per cent carbolic for disinfecting the hives and frames, as their cleansing properties are so much better than it, and Behring has shown that 5 per cent carbolic requires at least three hours at blood heat to destroy the spores of anthrax. In case the soap or the washing soda is used, however, it must be used as hot as possible. Of course anything which is of no value should be burned.

I trust that in this paper I have thrown a little light upon some of the facts in connection with the disease of foul brood, but, as I stated in the beginning, I reserve the privilege of submitting to you at a future meeting the results of next summer's work.

Before closing, I desire to express my thanks to your able secretary, Mr. Holtermann, for the assistance which he has given me, and also to Mr. Corneil, of Lindsay, for advice and for the use of volumes of all the principal bee journals, which he has supplied me with; also to Mr. Larrabee, of Michigan Agricultural College, in connection with the subject of comb foundation.

The next investigation to be considered is that by Prof. F. C. Harrison, professor of bacteriology of the Ontario Agricultural College. Previous to this Dr. William R. Howard published a paper on the subject, but this can be discussed better at a later time. In the paper by Professor Harrison, previously mentioned, the author gives a detailed description of the bacillus with which he worked. The description is as follows:

### THE ORGANISM.

*Bacillus alvei*, Cheshire and W. Cheyne, 1885, from the larvæ of bees suffering from the disease known as foul brood, la loque (Fr.), and faul brut (Ger.).

*Morphological characteristics.*—In form the organism is a slender bacillus with ends slightly pointed and rounded. “In the larval juices it is about 1-7000th of an inch in length and 1-20500th in breadth. On agar the bacilli vary considerably in size, averaging 1-7260th inch, some small as 1-10000th inch, and others as large as 1-5000th inch. When they have attained the latter size, division of the rod seems to begin. They are always somewhat pointed at their ends. Their average breadth is 1-30000th inch, ranging from 1-35000th to 1-25000th inch (Cheshire and W. Cheyne). Klamann (Bienenwirtschaftliches Centralblatt, Hannover, 1888, pts. 18 and 19) states that a clear space often appears in bacilli with pointed ends. From agar cultures twenty-four hours old, at 37° C., the bacilli average 4 *u* in length and 1.0 *u* in breadth. On gelatin cultures, grown at 22° C. they are somewhat shorter. They grow singly, but occasionally form chains of various length.

*Stains.*—With the ordinary aniline stains the bacilli color rather badly (Eisenberg, Bakteriologische Diagnostik, Hamburg, 1891, p. 298, and Klamann, Bienenwirtschaftliches Centralblatt, Hannover, 1888, pts. 18 and 19). The best stains are methylene blue and methyl violet. The bacilli accept Gram's stain, but the spores are not colored by it. I find the most satisfactory stain in methyl violet.

*Capsule.*—No capsule has been demonstrated by Welch's method.

*Flagella.*—The bacilli are actively motile and possess a single flagellum at one pole. The motility of the bacillus is quite pronounced in fresh cultures obtained from bouillon, agar, and gelatine. The flagella stain by Pitfield's, Loefflers's, and Van Ermegen's method.

*Spore formation.*—Spores are formed by the bacillus, and are large oval bodies averaging in length 1-1200th inch, and in breadth 1-23700th inch. On agar the spores are arranged in long rows, side by side, and are greater in diameter than the cells from which they are derived. The earliest appearance of spore formation takes place in forty-one hours, at 36° C. (Cheyne), but in some cases it is even sooner. The spores are formed in the center of the rod, and the formation occurs as follows: The rod begins to swell and becomes spindle-shaped. Occasionally the swelling is more marked at one end than in the center. The spindle-shape increases in size, and the center of the swelling gradually ceases to take the stain. The capsule of the spore is apparently formed within the rod and is not merely the outer part of the rod. In three or four hours the rod is seen to have almost or completely disappeared, although parts of the faint outline of the ordinary bacillus may be noticed.

*Germination of spores.*—Under favorable conditions the beginning of the germination of the spores takes place in about three hours. The spore loses its oval shape, becomes elongated, and is soon seen to burst through the spore capsule. It then presents the appearance of a short rod, with a pale envelope embracing one end. The rod gradually leaves the spore capsule, and then goes on multiplying as a full-grown bacillus. According to Eisenberg (Bakteriologische Diagnostik, Hamburg, 1891, p. 298) the spores are decolorized by the tubercle bacilli stain, but preparations may be obtained by using the Ziehl-Neilsen stain and alcohol for decolorization. The spores also stain by the methods of Neisser.

*Polymorphism.*—Variations in size and shape may be brought about by growth in acid media, or in media containing different sugars. These variations occur also in the same culture, subjected to exactly similar conditions of growth.

*Involution forms.*—Abnormal forms are especially abundant when the bacillus is grown on blood serum; peculiar Y-like forms and clubbed shapes are of common occurrence, and relatively few spores are found.

### BIOLOGICAL CHARACTERS.

*Bouillon.*—"In meat infusion at the temperature of the body they grow rapidly, causing muddiness and, after a few days, a slight but not tenacious scum" (Cheshire and W. Cheyne). In bouillon, with a reaction of +0.08 (Report of Convention of American Bacteriologists, Journal American Public Health Association, Vol. XXIII, 1898), at 37° C., there is a slight turbidity in fourteen hours, especially noticeable when the tube is shaken. In twenty-four hours, the liquid is uniformly turbid, with a very fine sediment. In forty-eight hours the turbidity increases and a pellicle commences to form. Reaction of the culture at this time, +0.07. After ninety-six hours the broth is clear, with a pellicle, white, rather massive,. and somewhat tenacious. There is also much sediment. Reaction, after ten days' growth, neutral.

*Glycerine bouillon.*—Media with original reaction of +0.08. At 37° C. the bouillon becomes slightly turbid in twelve hours and quite turbid in twenty-four, with a fine, whitish pellicle on surface, which does not extend to the sides of the tube. If the culture is shaken, the pellicle deposits in flaky masses. The reaction is +1.2. In thirty-six hours the turbidity clears, leaving the media bright, with a smooth, thin, tenacious, and white pellicle on the surface. In many cases the pellicle becomes very wrinkled and greasy looking. At the end of eight days the reaction is +2.2, and bouillon is several shades darker in color, but quite clear. The reaction after fourteen days' growth is +4.2. At 22°C. the same changes occur, but growth is slower. The bacilli are relatively less numerous than in bouillon and are slightly shorter and thicker.

*Glucose bouillon.*—With a reaction of +2, at 37° C., the broth is more turbid than plain bouillon after fourteen hours' growth; and in twenty-four hours the sediment is heavy and turbidity very marked, but no pellicle. In forty-eight hours the media is opaque and cloudy and the pellicle is beginning to form. In nineteen hours the broth is less cloudy but the sediment is heavier, and a white, thick pellicle is formed. It is often wrinkled, but not quite so much so as that on the glycerine broth. Reaction of broth after ten days' growth, +4.6. The bacilli are occasionally clubbed, and Y-like forms may occur. They average 5 *u* in length and may be slightly curved.

*Lactose bouillon.*—With a reaction of +1.06 at 37° C., the growth resembles that of plain bouillon for the first twenty-four hours; but at the end of forty-eight hours, it is more turbid. In ninety-six hours, a tenacious pellicle forms, less massive than that on glucose broth. Reaction after ten days' growth, +2.4. The bacilli average 3.5 *u* in length.

*Saccharose bouillon.*—With a reaction of +1, at 37° C., the turbidity and sediment are heavier than any of the other bouillons. In forty-eight hours the broth is quite opaque and whitish looking. A heavy sediment is then present, and pellicle formation is just beginning. In ninety-six hours the cloudiness is about the same, but there is an increase of sediment, and the pellicle is thin and membranous. Reaction of media after ten days' growth, +4.04. The bacilli average 5 *u* in length.

*Gelatine plates.*—At 22° C., in twenty-four to thirty-six hours, the colonies are small, round, oval, or lozenge-shaped, with peculiar projections or shoots from one end of the colony, giving it a pear-shaped or tadpole-like appearance, according to the amount of development of the projection. In many cases several of these outgrowths occur from different portions of the colony. By placing a cover glass on the surface of the gelatine and using objective 7, the bacilli may be seen moving around and around the colony and to and fro along the projections. At the end of forty-eight hours the colonies are larger. Fine processes or projections are shooting out into the gelatine in all directions, forming peculiar figures in circles or club-like forms. "It is impossible," says Cheyne, "to give a proper idea of the appearance of the growth. The forms assumed are the most beautiful shaped I have ever seen; but they are very numerous, always retaining the tendency to form curves and circles." After a time the gelatine is liquefied and the beautiful appearance of the colony is destroyed by the liquefaction of the gelatine.

These peculiar shaped colonies are most typical when the germ is taken from the diseased larvæ. After prolonged cultivation on various kinds of media, there is a tendency for the colonies to become round, and the peculiar branching forms are not seen in such numbers. The composition of the gelatine also seems to make a difference in the appearance of the colonies. In gelatine containing 12 per cent gelatine the processes are not so long. The same effect may be brought about by using more peptone in the composition of the media.

*Gelatin tubes.*—In stick cultures at 20° C., growth occurs all along the line of puncture. On the surface delicate branching or ramifying growth occurs in three days. These outgrowths soon run together and the gelatine is liquefied, first around the line of puncture, and in five days extends over the whole surface. The growth in the depth of the gelatine occurs as a whitish streak all along the needle track, and from this numerous shoots and growths branch out into the gelatine in all directions, giving a haziness to the appearance of the gelatine, which then begins to liquefy. If the inoculation is a heavy one, the shoots are coarse and may have club-shaped extremities, and from these swollen ends fresh shoots may start. Cheyne obtained the most characteristic growth in gelatine containing 3 per cent of peptone as well as 10 per cent gelatin. The whole tube is liquefied in from two to four weeks' growth. The liquid becomes yellowish in color and gives off a peculiar odor. Klamann states that in gelatin acidified with lactic acid the growth is slow and long threads are formed.

*Gelatine streak cultures.*—In gelatine streak cultures the appearance is very similar to what one sees in stick cultures. The bacilli first grow along the line of inoculation, and then throw out shoots into the surrounding gelatine, producing the appearance noted in the stick culture. The bacilli move to and fro along the channels of liquefied gelatine.

*Agar plates.*—On agar plates at 37° C., the colonies at the end of eight hours are small and burr-like, with spines protruding in all directions, giving the colony the appearance of a sea urchin. In some cases the projections are from one side or end. At the end of twelve hours the colonies have well-defined projections, visible to the naked eye. The colonies in the depths of the agar are more spiny, the processes being much shorter. On agar plates streaked with light inoculation most beautiful forms occur. The growth of the bacilli spreads over the surface and branches repeatedly, giving the appearance of seaweed. This appearance is distinctly characteristic; and as the growth is very rapid, this method commends itself for making a quick diagnosis of the presence of the bacillus in larvæ supposed to be diseased.

*Potato cultures.*—On potatoes the growth differs considerably, according to the reaction and age of the potato. Sometimes a brownish wrinkled growth forms, which gives off a peculiar odor; at other times a dryish yellow layer appears. ''The bacilli grow very slowly indeed at 20° C.'' (Cheyne, Journal of the Royal Microscopical Society, 1885, p. 381). Even at 37° C., they grow slowly.

*Milk.*—In milk at 37° C. coagulation of the casein occurs in three days. The milk becomes yellowish and gives off a characteristic odor. After several weeks' growth the curd is digested and a whey-like fluid remains.

*Blood serum.*—On blood serum at 37° C., the growth is rather slow and polymorphic forms are common. ''Very long filaments are formed'' (Cheshire and W. Cheyne, Journal of the Royal Microscopical Society, 1885, p. 381). These long forms may be from five to ten times as long as the average bacillus growing on gelatine, and consists of single cells. The filaments are often wavy or twisted and of unequal thickness. The extremities of the long, bent rods are often clubbed; and Y-like forms are numerous. Spores are formed very sparingly, and the blood serum is liquefied.

*Synthetic media (Uschinsky).*—In Uschinsky's medium no growth occurs; but if the medium is neutralized, good growth ensues. The bacilli occur in threads and a pellicle is formed.

*Dunham's solution.*—The bacilli are small when grown in this solution. No threads form, but there is a slight indol reaction after nine days' growth.

*Relation to free oxygen.*—Cheyne states that the germs grow most rapidly on the surface of agar and arrange themselves side by side; and they produce spores in this position after a few days' growth. Eisenberg (Bakteriologische Diagnostik, Hamburg, 1891, p. 298) says nothing under the head of aerobiosis. Howard (Foul Brood: Its Natural History and Rational Treatment, Chicago, 1894) writes that, ''It grows best under anaerobic conditions; is a faculative aerobe; grows under the mica plate, and in the presence of oxygen the growth is slight and slow.'' Howard also states that under anaerobic conditions it emits a foul odor resembling that of foul brood. It will be thus seen that Cheyne and Howard do not agree on this point. The former author also says that the characteristic odor is given off under aerobic conditions whilst Howard states that this smell is emitted under anaerobic conditions. Further, Cheyne states that the bacilli grow with great rapidity on the surface of agar, whereas Howard obtains his best growth under the mica plate, which does not give complete anaerobiosis. Howard's conclusions are thus at variance with Cheyne's, and my own results fully corroborate those of the latter author.

Howard states that the vitality of the spores of *B. alvei* is destroyed when exposed to atmospheric air from twenty-four to thirty-six hours. In making his experiments he took sterilized road dust and mixed it with the dry foul-brood masses from several cells, which were previously dissolved in distilled water. The mixture was worked dry and spread on sheets of paper, and trial cultures were made immediately and at intervals of every twelve hours for three days; and, according to his results, no growth occurred after thirty-six hours. In giving these results, Howard does not state whether he exposed the spores to sunlight or diffused light; nor does he mention the age of the dry foul-brood masses, which he used from several cells. These are points of considerable importance, for, as everyone knows, the disinfecting power of direct sunlight is much greater than diffused light, and the vitality of the spores from foul-brood masses of different ages varies considerably. This, I may add, has been clearly shown by some of my experiments, subsequently described. In my experiments the spores obtained from a pure culture on the surface of agar were spread on cover glasses and placed in a glass chamber, so arranged that a current of air was constantly circulating over them. This chamber was exposed to the ordinary light of a room with six large windows, and a cover glass was taken out every twenty-four hours and tested, to see if the spores would grow. This experiment was continued for one month, and at the end of that time the spores still germinated rapidly. In another experiment, spores spread on cover glasses were exposed to a very diffused light, simulating, as far as possible, the amount of light which would enter a hive. Cover glasses were taken out from time to time and transferred to agar, in order to ascertain if the spores were alive or not. The experiment was begun two years and four months ago, and from the last cover glass taken and placed upon the surface of an agar plate a copious and typical growth of *B. alvei* was obtained. Further, thin strips of filter paper, plunged into a bouillon culture and allowed to dry, were threaded on a wire suspended in a wire basket and so exposed that the air could freely circulate around them in the ordinary light of a room. Trial cultures were made at intervals, and at the expiration of six months the spores from the paper germinated when strips were placed on the surface of agar.

Again, a drop of bouillon containing spores was placed in a sterile tube and allowed to dry; and at the expiration of one hundred and twenty-four hours (thirty-six of which were in sunlight at a temperature varying from 30° to 37°C.) sterile bouillon was added. The tubes were then placed in the incubator, and in less than twenty-four hours a good growth of the germs had taken place.

From these experiments it will be seen that the results are directly at variance with Howard's statement, as they go to show that the vitality of the spores of *B. alvei* is not destroyed by exposure to atmospheric air, with or without sunlight, for even a much longer time than twenty-four to thirty-six hours.

With regard to the aerobiosis of this bacillus, good growth has been obtained in an atmosphere of hydrogen by Novy's method. Buchner's method also gave good results. The growths in the various media are very similar to those produced under aerobic conditions, but with this difference, that the surface growths are, as a rule, whiter in the hydrogen' atmosphere. In illuminating gas (water gas) no growth occurred, but the spores were not destroyed by the action of the gas; for when the gas was let out of the Novy jar, good growth ensued on all cultures. In acetylene gas, a restricted growth occurred. In fermentation tubes growth occurred both in the open and in the closed arm of the tubes. No gas was formed, the bouillon in the closed arm was uniformly turbid. Thus *B. alvei* is a facultative anaerobe.

*Production of alkali.*—In ordinary bouillin a slight amount of ammonia is formed. Control bouillon did not give the Nessler test. In glycerine and the sugar bouillons, there is no trace of ammonia. Cheyne's cultures are faintly alkaline, both before and after inoculation in meat infusion. Klamann states that ammonia is produced.

*Acids formed.*—A varying amount of acid is formed. All the sugar bouillons give an acid reaction.

*Formation of pigment.*—On potatoes a yellowish growth is produced; on all other media, the surface growth is white.

*Development of odors.*—Cheyne states that gelatine cultures give off an odor of stale, but not of ammoniacal urine, or what may be better described as a shrimpy smell; and this peculiar odor has been found by Cheshire to be distinctive of diseased larvæ. Klamann and Howard both state that a peculiar odor resembling that of the diseased larvæ may be noticed in artificial cultures.

*The effects of desiccation.*—I have already noticed, under the head of ''Relation to free oxygen,'' that the spores of *B. alvei* have considerable vitality in withstanding desiccation. My experiments prove conclusively that the spores are extremely hard to kill by desiccation and in this respect resemble those of anthrax, which are known to resist thorough desiccation for a number of years. One experiment which showed this characteristic was as follows: An agar plate completely covered with a typical growth of *B. alvei* was allowed to dry out completely, and was left exposed to the ordinary light of the room for seven months, and at the end of that time, a portion of the film was scraped off with a knife, placed on a suitable medium and incubated, with the result that a typical growth immediately ensued.

Spores on cover glasses were exposed to September sunlight (latitude 43°) for varying periods of time, and growth occurred after four, six, and seven hours' exposure. The age of the spores varied from five days to eighteen months; and spores three months old were not killed by seven hours' exposure.

From the symptoms given in this paper the disease with which Professor Harrison worked was doubtless American foul brood. From the discussion of geographical distribution this is also evident, for he says: ''I have examined diseased larvæ from Canada, from Europe, * * * Cuba, and thirteen States of the Union, ranging from New York to California and from Michigan to Florida. American foul brood is thus widely distributed, but from all these specimens Professor Harrison obtained a bacillus which he called *Bacillus alvei*.. Since we now know that *Bacillus alvei* is found in European foul brood and not in American foul brood, it is evident enough that the germ must have been another bacillus, European foul brood, as far as the author is able to learn, is not not found in Canada nor Cuba, and, although now found in several States in the northeastern United States and spreading, is not, as Professor Harrison would have us believe, widely distributed in the United States.

How can this be accounted for? The only way open seems to be in the identification of the bacillus. I do not feel qualified to pass judgment on the accuracy of the description of Professor Harrison, but the matter has been referred to Dr. White, and he assures me that the description just quoted fits the bacillus which is described as *Bacillus A* as well as it does *Bacillus alvei.* If this is true, we can only conclude that Professor Harrison, not knowing of the existence of two diseases, made a serious error in his identification. In no place does he speak of any difficulty in obtaining cultures from American foul brood. For comparison, Doctor White's description of *Bacillus A* (possibly *B. mesentericus*) is here quoted.

### BACILLUS A.

*(B. mesentericus?)*

*Occurrence.*—Found very frequently on combs, on scrapings from hives, and on the bodies of bees, both diseased and healthy.

*Gelatin colonies.*—Very young colonies show irregular edges, but very soon liquefaction takes place and the colony gives rise to a circular liquefied area, covered with a gray membrane, which later turns brown.

*Agar colonies.*—Superficial colonies present a very irregular margin consisting of outgrowths taking place in curves. Deep colonies show a filamentous growth having a moss-like appearance.

*Morphology.*—In the living condition the bacilli appear clear and often granular, arranged singly, in pairs, and in chains. The flagella are distributed over the body. The rods measure from 3*u* to 4*u* in length, and from 0.9*u* to 1.2*u* in thickness.

*Motility.*—The bacilli are only moderately motile.

*Spores.*—Spores are formed in the middle of the rod.

*Gram's stain.*—The bacilli take Gram's stain.

*Oxygen requirements.*—Aerobic and facultatively anaerobic.

*Bouillon.*—Luxuriant growth in 24 hours, with cloudiness of medium; a gray flocculent membrane is present. Later, the membrane sinks and the medium clears, leaving a heavy, white, flocculent sediment, with a growth of the organisms adhering to the glass at the surface of the medium. Reaction alkaline.

*Glucose.*—Luxuriant growth takes place in the bulb, with a moderate, flocculent growth in closed arm. The gradual settling of the organisms causes a heavy white sediment to form in the bend of the tube. The reaction is at first slightly acid, but subsequently becomes alkaline. No gas is formed.

*Lactose.*—Reaction alkaline.

*Saccharose.*—Reaction alkaline.

*Levulose.*—Reaction acid.

*Maltose.*—Reaction acid.

*Mannite.*—Reaction alkaline.

*Potato water.*—Reaction alkaline.

*Agar slant.*—A luxuriant growth takes place on this medium. The growth gradually increases to a moist, glistening one, being then friable and of a grayish brown color.

*Serum.*—A luxuriant, brownish, glistening, friable growth spreads over the entire surface. No liquefaction is observed.

*Potato.*—An abundant fleshy growth of a brown color spreads over the entire surface. The water supports a heavy growth. The potato is slightly discolored.

*Milk.*—Precipitation takes place rapidly, followed by a gradual digestion of the casein, the medium changing from the top downward to a translucent liquid, becoming at last semi-transparent and viscid.

*Litmus milk.*—Precipitation of the casein takes place usually within 24 hours, followed by a gradual peptonization. Reduction of the litmus occurs rapidly, leaving the medium slightly brown; later the blue color will return on exposing the milk to the air by shaking. Reaction alkaline.

*Gelatin.*—An abundant growth takes place with rapid, infundibuliform liquefaction. A heavy, white, friable membrane is formed on the surface of the liquefied medium. A flocculent sediment lies at the bottom of the clear liquefied portion.

*Acid agar.*—Growth takes place.

*Indol.*—None has been observed.

*Nitrate.*—Reduction of nitrate is positive.

Dr. William R. Howard, of Fort Worth University, Fort Worth, Tex., has published several papers on the bacteriology of bees diseases. In a paper published in 1894 (York Publishing Company, Chicago) he attributed "foul brood" to *Bacillus alvei.* Evidently he was dealing with American foul brood, and we now know that *Bacillus larvae* is present in that disease.

The same author undertook to determine the cause of pickle brood and described a specific fungus, *Aspergillus pollinis.* No investigator has since been able to find any such fungus in similar specimens.

In 1900 (Gleanings in Bee Culture, p. 121) this author published an account of some brief and entirely inadequate investigations made on what he chose to call "New York Bee Disease, or Black Brood." A specific organism, *Bacillus milii,* is described, but the view is expressed that this is modified, perhaps, by *Bacillus thoracis.* During the investigations of the Department of Agriculture it has been learned from whom Doctor Howard got his specimens, and the same men have furnished specimens which they declare to be of the same diseased condition as those furnished Doctor Howard. These, however, contain *Bacillus alvei,* and the disease is the same as that described by Cheyne, now named European foul brood.

It is most unfortunate for Doctor Howard that in not a single point have his descriptions been verified. Certainly it would seem unwise in him to put out the names *Bacillus milii* and *Bacillus thoracis* as new species without descriptions and after so short an investigation. We can not, therefore, sympathize very much with him when his views are overthrown.

The American bee journals and text books on apiculture have until recently contained statements to the effect that *Bacillus alvei* is the cause of the disease which has been almost universally called "foul brood." This is due not only to the publication of Mackenzie, Harrison, and Howard, but very largely also to the attempt to determine *Bacillus alvei* by microscopic examination. The best-known case of this is probably the examination of diseased brood made by Mr. Thomas William Cowan, editor of the British Bee Journal. On a visit to Medina, Ohio, Mr. Cowan was shown a sample of diseased brood, and after a microscopic examination he announced that he found *Bacillus alvei,* and that the diseased condition is identical with that found in England. That this ropy type (for such it was) is found in England can not be doubted, but that the germs which Mr. Cowan saw were *Bacillus alvei* may well be doubted. I have taken particular pains to ask Mr. E. R. Root, who was present, whether Mr. Cowan made a cultural examination, and was assured that the microscopic examination was the only one made.

The announcement of this examination in Gleanings in Bee Culture and the A B C of Bee Culture, coupled with the excellent reputation of Mr. Cowan, made this appear convincing to American bee keepers. It must be remembered, however, that at that time no one had questioned the presence of *Bacillus alvei* in American foul brood and on finding bacilli the conclusion that they were *Bacillus alvei* was natural, even though erroneous.

Mr. Edward Bertrand, in his book "Conduite du Rucher," makes a similar announcement, stating that he and Mr. Cowan examined brood described as ropy and found *Bacillus alvei.*

[Mr. Radant: I have received a letter from Mr. Bertrand. He informs me that they (Mr. Cowan and himself) had examined foul brood, but I know from the tone of the letter that no cultures were made.]

To indicate how much reliance may be placed in microscopic examinations in the absence of cultural tests, let me quote from Sternberg's Text-book of Bacteriology, 1901 edition, pages 13 and 14. It should be borne in mind that this refers to all microscopic examinations of bacteria, and not specifically to bee diseases.

> The bacteria are also classified according to their biological characters, and it will be necessary to consider the various modes of grouping them from different points of view other than that which relates to their form. This is the more important, inasmuch as we are not able to differentiate species by morphological characters alone. Thus, for example, there are among the spherical bacteria, or micrococci, numerous well-established species which the most expert microscopist could not differentiate by the use of the microscope alone; the same is true of the rod-shaped bacteria. The assumption often made by investigators who are not sufficiently impressed with this fact, that two micro-organisms from different sources, or even from the same source, are the same because stained preparations examined under the microscope look alike, has led to serious errors and to much confusion. As an example of what is meant, we may refer to the pus organisms. Before the introduction of Koch's "plate method" micrococci had been observed in the pus of acute abscesses. Some of these were grouped in chains—streptococci—and some were single, or in pairs, or in groups of four; but whether these were simply different modes of grouping in a single species, or whether the chain micrococci represented a distinct species, was not determined with certainty. That there were in fact four or more distinct species to be found in the pus of acute abscesses was not suspected until Rosenbach and Passet demonstrated that this is the case, and showed that not only is the streptococcus a distinct species, but that among the cocci not associated in chains there are three species which are to be distinguished from each other by their color when grown on the surface of a solid culture medium. One of these has a milk-white color, one is of a lemon-yellow color, while the third is a golden-yellow.

This brings us down to the work of Doctor White. His investigations were begun with Dr. V. A. Moore in 1902, and in January, 1903, a preliminary report was published. During the first year specimens of "black brood" were examined and to the surprise of the investigators *Bacillus alvei* was found in every case. Obviously, then, they were working with the foul brood of Cheshire and Cheyne (European foul brood). In a second short paper by Doctor White a brief note is given concerning some work done on the "ropy type" of foul brood. He recognized that he was dealing with a disease the cause of which had not been described and the disease is called for the time "X brood" and the bacillus, *Bacillus X*. The final results of the investigation appear in Technical Series, No. 14, Bureau of Entomology, under the title "The Bacteria of the Apiary, with

Special Reference to Bee Diseases." Doctor White's description of *Bacillus larvae* is as follows:

### Bacillus Larvae.

*Occurrence.*—Constantly present in diseased brood from colonies affected with American foul brood.

*Gelatin.*—There is no growth.

*Morphology.*—It is a slender rod, having a tendency to form in chains. This is especially true when grown in bee-larvæ bouillon.

*Motility.*—The bacillus is rather sluggishly motile.

*Spores.*—Spore formation takes place. This can be observed best in the different stages of the disease and decay of the larvæ.

*Oxygen requirements.*—When Liborius's method is used, the best growth usually appears near to but not on the surface. After a few generations a surface growth may be obtained.

*Bouillon.*—There is no growth.

*Glucose bouillon.*—There is no growth.

*Lactose.*—There is no growth.

*Saccharose.*—There is no growth.

*Agar plate.*—There is no growth.

*Bee-larvae agar.*—The inoculations must be made with the medium liquefied. The growth takes place near to but rarely on the surface. Cultures must pass through a few generations before a satisfactory surface growth can be secured.

*Bee-larvae agar slant.*—On the surface of this medium a thin, gray, nonviscid growth takes place.

*Glucose agar.*—Slight growth has been observed in the medium. No gas is produced.

*Potato.*—There is no growth.

*Milk.*—There is no growth.

*Litmus milk.*—There is no growth.

*Fermentation.*—In bee-larvæ bouillon no gas is produced.

*Indol.*—There is no growth in sugar-free bouillon.

To summarize, then, *Bacillus alvei* is found universally in European foul brood; *Bacillus larvae* in American foul brood. No specific micro-organisms have been found for the so-called pickle brood or paralysis. Knowledge of the two worst brood diseases is accurate enough to enable us to combat them by applying principles acquired by comparison with results of work with other micro-organisms.

That our knowledge is complete is far from true. Not only is there much to be learned which is of purely scientific interest, but points of the highest practical importance are yet undetermined.

[Note.—Several other papers of importance have been issued on this subject which were not discussed at the Inspectors' meeting. They, however, have an important bearing on this subject. Lambotte decided that *Bacillus mesentericus vulgatus* causes "foul brood," or, in other words, that *Bacillus alvei* is but a variety of *Bacillus mesentericus*. His work, however, is far from convincing. The principal point of interest in this regard is that he had great difficulty in getting a growth from the ropy type of foul brood (American foul brood) on ordinary media. Burri in 1904 published an account of his work and found *Bacillus alvei* in a few specimens from Switzerland (indicating that European foul brood is found there), but found another organism which grows with difficulty; the latter is undescribed and unnamed, and it is possible and probable that he worked with *Bacillus larvae* White. Maassen (1906) found the same difficulty, isolating *Bacillus alvei* in only 13 specimens of diseased brood out of 112 received. He, too, found an organism which could be made to grow on ordinary media only with difficulty and called by him *Bacillus brandenburgiensis.* It is undescribed, so far as is known to the writer. He also claims to have found another organism, *Spirochaete apis* Maassen, but has not established any casual relationship.

These papers all tend to confirm the work of Dr. White. *Bacillus alvei* is not found in the ordinary ropy type of "foul brood," but another organism is; this is probably the *Bacillus larvae* of Doctor White.

In the face of all these facts several prominent bee men of England are attempting to discredit all this work, the criticism, so far as is known to the writer, being based entirely on comparisons of literature and on an entire lack of investigation. They have, further, misread the papers issued by the Department of Agriculture on this subject. It seems entirely unnecessary, therefore, to review the criticism in detail.—E. F. P.]

Mr. E. R. Root, of Medina, Ohio, gave a very interesting talk on wintering bees, with particular reference to confining bees in their hives both in cellar and out-door wintering. This confining of bees has proven an entire failure so far.

A. F. Satterthwait read the following paper on "The American Relatives of the Honey Bee."

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## American Relatives of the Honey Bee.

### A. F. Satterthwait.

*Mr. President, Fellow Members of the Pennsylvania State Bee-Keepers' Association and Friends,—*

Last month your past president requested me to contribute a communication to your present program, and suggested or approved the subject title which has just been announced. The subject is large and would allow of infinite detail in treatment. My purpose is to so approach the subject as to enable you to make intelligent individual observations, aiming at ultimate important purposes.

Classification is a process of sorting into grades and into groups, and although the suggestion may seem to be the beginning of untold difficulties, each one of you will recognize that it is a process of every day business—classifying—or sorting if you choose—honey from the hive, or potatoes, corn or fruit from fields, orchards or vineyards, for profit, utility or convenience. Classification being a common thing then, you will cease to be alarmed at the mention of the process applied to insects. To separate the "Relatives of the Honey Bee" from other insects, ascertain first whether it is of the order Hymenoptera, briefly characterized thus: Insects with four membranous wings with few or no cross-veins. Hind wings smaller than front wings. Mouth parts for biting and sucking. The abdomen of the female usually furnished with sting or saw. The metamorphoses is complete. Wings sometimes wanting. If its characters conform to this description, we may follow a further classification according to any one of several authors. Mr. E. T. Cresson published a synopsis of the Hymenoptera of America north of Mexico (Supplementary Volume, 1887, Tr. Am. Ent. Soc.) which though based on an earlier synopsis by Dr. Hartig (Wiegmann's Archive, 1837, No. 2) is yet a very complete treatise.

Mr. Cresson divides the Hymenoptera into two divisions, the first having a 2-jointed trochanter, the second, a 1-jointed trochanter. To the former belong those Hymenopterous insects with abdomens broadly attached to the thorax, and those with the posterior abdominal segment divided beneath with the ovipositor issuing before the apex. To the latter—the 1-jointed trochanter group—belong two small groups, the one having the basal joint of the posterior tarsi cylindrical, the other group with this joint almost always more or less dilated and densely pubescent. This little group is the Anthophila and contains the two families Andrenidæ and Apidæ. These two families and a small family of Cuckoo bees which were otherwise grouped on account of the cylindrical basal joint of the posterior tarsi, are inclusive of all so-called bees. I choose to minimize the relationship between these lazy-footed impostor bees and the flat-footed bees of the Andrenidæ and Apidæ and restrict my further remarks to the latter.

The Andrenidæ are separable from the Apidæ in that the former have a so-called short tongue while the latter have a long tongue. In classifying dry specimens it is sometimes impossible to see the relative length of the tongue, hence the propriety of Cresson's treatment of these two families together, classifying to genus on less reliable though more convenient characters.

Of the Andrenidæ, all species are believed to be solitary, though many may have their solitary burrows assembled in communities. Many of these sink tunnels vertically in the ground, with cells excavated horizontally, one cell to a branch, and stored with pollen and nectar paste. To this family belong some bees as large as the honey bee, and some of the smallest known bees, as small as 1-10 inch in length, genus Halictus.

Members of the genus Halictus burrow into vertical cliffs or banks, some species operating "apartment houses," several couples using a common corridor, but remaining solitary in their respective branch burrows or "flats."

Cresson credits Andrenidæ with 144 North American species; of these 41 are genus Halictus, 44 Andrenus. The Andrena then build villages or individual houses in horizontal land and Halictus cities of apartment houses in vertical land, as a rule. (See Comstock's Manual.)

Of the North American Apidæ (Cresson recognizes 517 species), all are believed to be solitary except the species of Bumbus (Bumblebee genus) and Apis mellifica.

Among the leaf cutters, genus Megachile, are some bees as large as the honey bee. These are sometimes carpenters along with their leaf cutting trade, boring a tunnel in wood or perhaps generally in the pith of certain stalks and lining these cells with cut leaves. The small carpenter bee (Ceratina dupla) builds in tunnels in Sumac, etc. placing pollen at the far end, laying an egg and sealing the cell and then superposing a cell and continuing thus to the outlet. The female guards her nest till the young fly. The egg in the first or bottom cell produces a matured bee first, but this bee waits till the others have cut their way out. When all of the first brood are out, the tunnel is cleaned and used by one of those just emerged. If more observations would have been made in such detail, much might be gained of practical value as well as of peculiar interest.

The Wickhams have published a book giving detailed observations which are very interesting and which certainly will throw light sometime on a vulnerable or beneficial point in the life history of one or another beyond what is already seen. In the multiplication of details, general and valuable truths will be found.

The large carpenter bee (Xylocopa virganica) so common about old buildings, lacks the pollen pouch on the hind legs, which is conspicuous on Bumble Bees. Their cells are constructed in tunnels in wood, and are stored with pollen and nectar.

The Bumble-bees are our only social bees. In these the fertilized queen alone winters over. She is obliged to find a suitable nest and start housekeeping alone. She prepares a mass of pollen and on it lays her eggs. The larvæ eat into the pollen mass from all directions, and when full fed, spin their cocoons and pupate. The queen strengthens the cocoons with wax. After these first, which are workers, emerge, the cells are stored with honey by the workers, which now carry on all the work except egg-laying. Later in the season only males and females emerge, the females alone to winter over.

Among the bumble-bees, Inquiline or guest bees may be frequently found. The relation of these Inquilines to the bumble-bee, although entirely different insects from the bee moth, is similar in a general way to the relationship of the bee-moth to the honey-bee.

Now, having outlined the classification of bees in order that you may have a working basis for making observations in the future, I would wish now to show you a useful purpose towards which careful observation will lead us, and to which end observation should be quickened. It is inevitable that bees are beneficial in cross-pollination of flowers. Who can tell though, what species are useful in the cross-pollination of the apple, and what of the strawberry? Why might it not be so, that some of the solitary bees which are smaller would be potent factors in the cross-pollination of clovers? Perhaps sometime it will be found that a community of the solitary bees have been instrumental in causing the difference of honey production between two areas of a given species of plant of approximately the same locality. Their influence might be direct or indirect. If these questions may be answered sometime how may that time be hastened? It is necessary that species taken definitely on a certain plant shall be identified with the plant, and this recorded with date, place, collector. Mr. Chas. Robertson of Illinois, and Prof. T. D. A. Cockerell have done much towards this end by publishing just such records. It will take a large volume of records, however, to give an approximately complete list of plants which a given species of bees will visit, or of bees which are attracted to a given species of plant. Records of life habits of species would be a necessary item in the ultimate usefulness of such research.

It has come to my attention that our State Zoologist, Prof. H. A. Surface, would be glad to receive specimens of native American bees with whatever data could be given, and when taken on flowers, the flower to accompany each bee thus collected. This being done, the use of the zoologist's office in this matter might in a comparatively short time make possible some practical conclusions.

Friday afternoon, the meeting was called to order by Prof. H. C. Klinger. The following committee on resolutions was appointed, Messrs. R. D. Barclay, J. K. Owen and John Rein.

Prof. Surface, Rev. H. W. Bender and Mr. E. E. Pressler were appointed as a committee to wait on the Governor and invite him to be present at our meeting. The committee reported that they had seen the Governor's private secretary, and would hear from him later.

Mr. Isaac Miller, who had met with phenomenal success with outdoor wintering of bees, gave his method. In June he sees that each colony is headed with a good, prolific young queen. In the fall he moves his hives as close together as possible, side by side, and puts temporary sheds over them. He leaves a two-inch space back of the hives, which is packed with wheat or rye straw, short in super, long back of hive. The west and north ends are boarded up. The hives are placed on 2 x 4 inch scantlings.

Mr. S. K. Snyder, of Lebanon, Pa., gave a demonstration of his method of queen-rearing. He has succeeded in eliminating the swarm box entirely in cell building. This demonstration called forth many questions from the audience, and was very instructive as well as interesting.

Dr. Phillips emphasized the point that six hours of broodlessness caused nurse bees to have an excess of food elaborated in the stomach, which they are anxious to get rid of, and will therefore give a superabundance of royal jelly to the newly introduced larvæ, which is necessary to produce strong, vigorous queens.

Mr. Hershey, of Mt. Joy, gave his method of rearing queens, with particular reference to his section-box nucleus.

Mr. B. A. Hadsell, of Buckeye, Arizona, gave a talk on Bee-Keeping in the Southwest, and particularly dwelt on their wintering proposition and honey flow. This talk was greatly appreciated.

Mr. E. R. Root, of Medina, Ohio, gave a very interesting talk on how to subdue bees for a public demonstration.

Messrs. Miller, Collier and Wood were appointed as the Committe on Awards.

At the evening session, a motion was passed admitting to membership Mr. E. R. Root, of Medina, Ohio; Miss Susan E. Williams, of Moorestown, N. J.; and Dr. E. F. Phillips, of Washington, D. C.

Prof. Surface gave a short talk on bee-stings as a cure for rheumatism, and followed it with a demonstration how to apply the remedy, the victim being Mr. Redsecker Young, of Middletown, Pennsylvania, who had only taken a few applications, and had been greatly benefitted thereby.

Mr. Charles Stewart, New York State Bee Keeper, third Division, Sammonsville, N. Y., then read the following excellent paper on State Bee Laws:

## State Bee Laws.

### Charles Stewart.

Probably no state has more practical and effective bee laws than the State of New York, and after an experience of eight years in their enforcement, I am able to suggest but a very few improvements, and it is my intention to point out to you these improvements and emphasize the leading features of a wise law that those who are seeking for information along this line may be benefitted.

It requires a nice discrimination to frame a law that will be effective and at the same time neither oppress the bee keeper nor hamper the inspector in the discharge of his duties.

An inspector should be selected by competitive examination that only the very best may be had.

A salary of not less than $800 per year and expenses should go with the office as an inducement for the brightest men to take up this work and not those who have proven themselves failures in our chosen pursuit.

An inspector should be paid by the Department of Agriculture and should make the reports of his work and expenses to that department. Should he prove incompetent he should be removed and the next man on the eligible list be substituted.

A competent inspector will not only understand bee keeping in all its branches as well as bee diseases, but must be a man of tact and diplomacy and a shrewd judge of human nature. In short, he must be able to handle bees as well as men.

To make the inspector's work effective, wise laws must be enacted to assist him.

Every law must have a penalty attached or it loses its effect. I will call your attention to some important points that should be embodied in your bee laws.

No person shall keep in his apiary any colony of bees affected with a contagious disease, and every bee keeper when he becomes aware of the existence of such disease shall immediately notify the Department of Agriculture or its agent of its existence.

The Department of Agriculture on receipt of such notice shall send a competent person to examine such apiary and all other apiaries in the immediate vicinity.

If a contagious disease is found to exist in said apiary, he shall give to the owner or caretaker full instructions how to treat the disease, and if after proper treatment or lack of proper treatment on the part of the owner or caretaker, the bees shall not be cured, he may cause them to be destroyed in such manner as may be necessary to prevent the spread of the disease.

For the purpose of enforcing this act the inspectors shall have access to all places where bees, honey or appliances used in apiaries may be, or in any place where it is believed any commodity is offered or exposed for sale in violation of this act.

No owner or caretaker of a diseased apiary, honey or appliances shall sell, barter or give away any bees, honey or appliances of such apiary which shall expose other bees to the danger of disease, nor refuse the inspector admission to inspect said apiary, honey or appliances and do such things as the inspector deems proper for the eradication of the disease.

No person should be allowed to move bees from any locality where disease is known to exist without the consent of the inspector.

All transportation companies on receipt of a consignment of bees outside of the state shall at once notify the Department of Agriculture of the State to which the consignment goes of such shipment, giving destination and names of consignor and consignee.

The apiary of every queen breeder should be inspected at least once each season, and if no disease exists the inspector shall give him a certificate in writing to the effect that his apiary is free from disease.

The above clause might seem at first thought to be a hardship to the queen breeders, but knowing that many refrain from buying queens from fear of importing disease, there is no doubt that when it was generally known that these yards were under the surveillance of an inspector, sales would be greatly increased.

I believe the above points of law well enforced will be found all that is necessary and prefer rather than weary you that you take up this subject on the floor of this convention, and I shall be pleased to give you the benefit of my experience if there are any points that I have failed to make clear.

Dr. E. F. Phillips then read a paper on "Bee Legislation."

Saturday, A. M., January 19th, 1907. The meeting was called to order by President H. C. Klinger.

The first subject on the program was a paper on "Extracted Honey," by Mr. Charles N. Greene, Troy, Pa., as follows:

## Extracted Honey.

**By Charles N. Greene.**

*Mr. President, Officers, Members of the Pennsylvania Bee-Keepers' Association, and Friends,—*

I appreciate the opportunity of presenting for your consideration a subject of so much importance to the bee-keepers of the State as the subject of Extracted Honey. In this State the production of extracted honey seems to be a matter of very little consideration in the management of the bees. The only extracted honey if any at all produced is that obtained by throwing out the honey from the partly filled sections at the close of the light and dark honey flows with possibly the contents of an occasional brood comb. I am at a loss to know why this lack of interest in extracted honey is so general throughout the State unless it is that our bee-keepers are extremely conservative and loath to introduce new methods until convinced that they are better and will be successful in their hands. In this paper I shall not attempt to account further for this lack of interest in the production of extracted honey, but rather give some of the reasons why extracted honey should and can be produced in the apiaries of this State. Other reasons will undoubtedly suggest themselves to you but I will be pleased if it interests you sufficiently to investigate the subject of the production of extracted honey in your apiary. It is worth your consideration and thought.

In passing allow me to say that this throwing out the honey from the partly filled sections is a kink in the production of comb honey well worth all the trouble, expense and time required to do it. In a single season, I have known it not only to pay for an extractor and packages in the quantity of extracted honey obtained by the manipulation but very materially increase the value of the comb honey produced, the honey being all light or dark and not mixed.

The practical bee-keeper, the fellow who keeps bees for the profit he can see in bee-keeping, and depends in any measure on the bees for his bread and butter will ask in the first place if extracted honey is marketable. If we can give him an affirmative answer and demonstrate that our answer is correct, we will have his attention and have the opportunity of presenting some of the reasons why extracted honey should and can be produced in our State.

Extracted honey is marketable. In support of this statement I have only to call your attention to any of the market reports or refer you to the experience of those who produce extracted honey. The producer will tell you there is both a home and a general market and many times advise you to make the most of the home demand. For some years I have produced a nice lot of extracted honey from a small apiary and my home market has taken all I produced and often my crop has not supplied the demand. I started out to market the honey in the common glass fruit jars, and have found them an excellent package for that purpose. The honey has always been of excellent quality and ripened well. I have received the uniform price of $.30 and $.35 per quart can for the dark and light honey respectively, allowing five cents for the can if returned. As the can is a household necessity but very few are ever returned. This makes a very good price for the honey, being not far from ten cents per pound for the dark and twelve cents for the light honey, much more than I could have obtained for my product in the general market. During the last few years since the candied honey has been brought to the attention of bee-keepers by the writers on apiacultural subjects, I have discovered that a demand can be readily worked up for honey in that style. I have had little experience along this line myself, but I have noted from the efforts of others in our part of the State that a trial of the candied honey will in almost every instance make a customer for some honey put up in that way. The package that has been used in the experiments referred to has been the common paper oyster pails, usually the quart size and has sold for twenty-five cents. The oyster pails may not be the best package for all sections, but it is a success in our part of the State. It is a neat wholesome package and where expense is a consideration a good one. I think that for a critical trade that possibly a nicely labeled package might be better and would advise its trial. The honey has been candied by filling the pails and setting them in and out of a refrigerator a few times. So much for the home demands as I have found them and I think the results will vary but little in any part of the State. My home is in an agricultural district and the outlet of honey in the home market is limited so that upon making the product of a larger number of bees extracted honey I have turned to the larger markets for my outlet. Thus far I have had no difficulty to market the honey in the ordinary packages as sold by the dealers in bee supplies, I have shipped in the twin sixty pound tin cans, kegs and casks, and found them all satisfactory. The prices received have been much less than those received in the home markets, but still very remunerative. They have corresponded very closely to those quoted in the bee journals and general market reports.

If extracted honey is marketable can it be produced in our State?

In our part of the State we have a wonderful succession of honey producing flowers for the welfare of the bees. Flowers of one sort or another come in succession from the time the alders, elm, soft maple and dandelions bloom in the spring, until the frost destroys the last of the asters and golden-rod in the fall. With this flora of honey bearing plants from early spring until late autumn we have a continual source of nectar with but few interruptions and feeding rarely enters our problems except that of stimulative feeding in the early part of the year. I do not remember a year when there was a failure of the honey bearing plants. We thus do not have the discouragements that many of the great honey producing sections of the West have in their off years. On the other hand, I would not have the uninitiated expect a full crop of clover, basswood and buckwheat honey every year, yet it rarely happens that there is not an excellent flow from one and sometimes two of the above sources. With the succession of nectar producing plants in the spring which nicely supplies the needs of the bees for brood purposes if the bee-keeper will give the bees close attention there is an opportunity every season for a crop of honey, and I think that you will agree with me that old Pennsylvania is a good place to produce extracted honey.

It is now generally recognized as a matter of great importance to furnish the bees with liberal quantities of foundation in the production of comb honey. It is an item of considerable expense to the apiarist but it is in recognition of the immense amount of time and energy required of the bees to gather the nectar and then secrete the wax necessary to build the comb in which to store the crop of honey. It is a scientific fact that it requires the consumption of anywhere from 25 to 50 pounds of *nectar* for the bees to secrete one pound of wax. If but half that amount is required for the secretion of wax there will be a great saving to the bees if we can lessen the comb building in a season's work. In the production of extracted honey this is practically accomplished for we furnish the combs and it is only necessary for the bees to fill and cap them at most. A small item when compared to the construction of the entire combs. This saving in the production of wax is one of the reasons that an extracting colony seems to accomplish so much more than a colony of like strength and energy producing comb honey. So that summing up this phase of the production of extracted honey we may safely expect to save the annual expenditure for foundation, to enable the bees to increase their product by whatever the saving in nectar is in the production of wax, and to add to the credit of extracted honey the wax that can be rendered from the season's cappings. This last item is one of importance.

In the work of producing extracted honey the bee-keeper keeps in very close touch with the condition of the brood chamber. He is obliged to know its condition as well as the condition of the super if he works the colony to its capacity. This knowledge of the interior of the hive enables the bee-keeper to avoid the crowding of the queen and bees which is one of the most frequent causes of swarming. It is a well known fact that if the bees have plenty of room for the storage and nectar as it comes from the fields and the queen is not hindered in her production of brood that one great obstacle to bee-keeping is overcome. In the production of extracted honey the supers should be ready as in the production of comb honey to go on the bees as soon as they begin to gather more nectar than is necessary to supply the needs of the hive. In the production of comb honey it is customary to watch the supers to determine the need of more room, but in the production of extracted honey it is not necessary to wait for the honey to be capped before giving more room for storage. When a super is nearly filled raise it up and put another under it. The reason for this disregard of the capping and comb building is that the capping has no important bearing as to the market value of extracted honey. The value of extracted honey depends upon the condition of the honey in regard to moisture. If it is left on the hive until the moisture evaporates I am of the opinion that the caps are immaterial. We are thus able to furnish room for the storage of nectar without thought of its immediate evaporation and capping which works very advantageously in favor of the bees and their master.

At the beginning of the season the brood occupy very limited spaces of the brood chamber within easy reach of the supplies. As this brood develops the nearby supplies with those coming from the fields daily are used, and the size of the brood nest is increased until the capacity of the queen is reached. Now if the storage of nectar is not sufficient and the bees instead of placing it as it comes from the fields in the surplus arrangements place it in the brood combs so recently occupied with young bees thus crowding the queen and curtailing the production of brood which is of so much importance to the welfare of the colony and production of the apiary. Another reason then why a bee-keeper of our State should produce extracted honey is that it enables him to largely determine whether the product of his apiary shall be bees or honey. It is a fact that both bees and honey cannot be produced at the same time. Extracted honey enables the bee-keeper to more nearly control swarming and make his product marketable honey and in the greatest quantities from a given number of colonies of bees.

We have all probably observed the necessity for the bees to be strong to accept and enter the surplus arrangements in the spring or early part of the season. We have also observed that the bees in the production of comb honey will go into the supers very much sooner if the sections have starters of foundation than if the plain empty sections are put on the hives. We have also observed that the supers will be more quickly occupied if the supers contain a few sections filled with comb, bait comb. Some of us have also noticed that as we increase the quantity of comb in the surplus arrangements and bring it in close communication with the brood chamber that we may reasonably expect the chances of the bees going into the supers and beginning work to increase in the same ratio that the comb is increased until with the extracting supers it is a certainty if there is nectar to more than supply the needs of the bees. If we find an exception to this rule I think I am safe in saying that it will be in the case of a colony too weak to occupy the brood chamber or one on the verge of swarming. In the first instance the bees have room and need all the nectar that is gathered and we neither want or expect surplus honey from such a colony. But mark you as soon as such a colony becomes strong enough it will enter the extracting supers as soon as its stronger neighbors. It will not have to be fairly forced into the surplus apartment as sometimes happens in the production of comb honey. Another reason why we can reasonably expect extracted honey to be produced in our State profitably. We can secure something of an income from colonies of bees too weak to produce comb honey and in seasons when the supply of nectar is less than is required in producing a good crop of comb honey we may secure a fair crop of extracted honey.

Although in converting a comb honey apiary into an extracting yard requires a great deal of changing, abandoning some fixtures and replacing some of the others, yet when once brought about there is a decided advantage in the extracting yard if the items of expense and labor are considered. You are all familiar with the work that is necessary to prepare for a crop of comb honey. Sections, foundation, shipping cases, etc., all have to be gotten ready for the crop long in advanse of the time we may reasonably expect it. Quite often the most expert find that they have underestimated their needs and then when the flow is on they hasten to make good their error by sending to the nearest source of supply for what they need and dealer, transportation company, errors of some sort, change of weather or something does not work out as they would like and the result is that the product of the apiary suffers considerably along with the disappointment. You are also familiar with the skillful and careful work required to prepare a crop of comb honey for the market after we have succeeded in getting it produced by the bees. will only call attention to all this expensive work feeling that your experiences corroborate my statement that the preparation of comb honey for market is a very expensive operation when properly done. With the producer of extracted honey this is all different when once provided with supers and comb for any reasonable requirements of a yard. If he finds he is embarrassed with an unprecedented flow of honey from any source he has only to set the wheels of his extractor in motion and he can give his bees almost unlimited room in which to store the nectar. In fact he can almost work the extractor at one end of the yard while the bees are filling the combs in the other. At any rate if at all attentive he need not allow his bees to suffer much for room. Extracting can be done when it is necessary. As the extracting combs are serviceable for years the only package the producer of extracted honey buys are the packages, cans, kegs, or casks, to market the honey in, packages corresponding with the shipping cases and crates in comb honey production, and not much if any more expensive. Then when the honey is extracted unless done in an emergency, as just outlined, it is practically ready for the market. I would however, in all cases, advise ripening extracted honey as much as possible before marketing. This can be done by a little attention and storing it in warm dry places with a chance for the surplus moisture to pass off. As briefly outlined I think that you will admit a crop of extracted honey is more easily produced than a corresponding crop of comb honey from the same apiary. Being put up in packages less liable to injury by moving it is more easily and safely marketed than comb honey.

The last reason that I will call to your attention why the beekeepers of Pennsylvania should produce extracted honey is that they should reap some of the advantages of the National Pure Food Laws which went into effect the first of last January. This enactment of statute by the U. S. Government makes its provisions applicable to all the States, territories, and dependencies. It is a uniform law regulating the sale of food. The State of Pennsylvania has had the benefit of pure food laws which have been in many ways very good and effective but with the enactment of a national law I think that we may reasonably expect an increased demand for this product of the bees which when properly cared for and produced is the most delicious of all sweets and when taken into the human stomach is assimilated with the greatest ease. In the past, large quantities of glucose have been substituted for honey until it was nearly impossible to purchase the pure honey in any other shape than in the comb. With the consumers aware of the fact that a large part of the extracted honey on the market in its attractive packages is not pure honey it is a wonder that there was as much of a demand for extracted honey as we find. With the changes that we can safely expect I think that there will be for some time an increasing demand for extracted honey. If all the prejudice to the use and the draw-backs to the demand for extracted honey is largely overcome by this enactment of national law it is incumbent for the bee-keepers of Pennsylvania to do their share toward supplying the demand which will surely come for extracted honey. If the production of extracted honey under the disadvantages of the past has been profitable, I think with the prospect of a future a word to the wise will be sufficient. C. N. Green.

The Committee on Awards reported as follows:

First Award on Comb Honey, Mr. S. E. Johns, Concord, Pa.
Second Award, Mr. E. E. Pressler, Williamsport, Pa.
First Award on Extracted Honey, Mr. F. G. Fox, Erwinna, Pa.
First Award on Bee-keepers' Supplies, Messrs. Cleaver and Greene, Troy, Pa.

Signed:
Isaac F. Miller,
J. S. Colyer,
J. C. Wood,
*Committee.*

A motion was made and carried that the Committee add to the Awards of Merit in exhibit, the number of competitors.

Committee on Supplies reported that a 10 per cent. discount was secured on bee fixtures of the A. I. Root and of the G. B. Lewis Companies, and on queens and nuclei of Messrs Penn G. Snyder and Isaac F. Miller on purchases made by members of the Association.

Motion was made and carried that the Secretary be instructed to pay the expenses of Dr. Phillips and Mr. Stewart.

A vote of thanks was unanimously given to Mr. E. R. Root for his kindness in attending our meeting and for the excellent service he here rendered us.

A paper on "Successful Bee-Keeping" was ably presented by Mr. Charles Stewart, as follows:

## Successful Bee Keeping.

### Charles Stewart.

When a State Bee-Keepers' meeting is held you will always find the brightest and best men of our ranks present. It is for that reason that I am especially pleased to be with you on this occasion.

If I had not been successful in our chosen pursuit I should hardly feel justified in talking on this subject which has engaged my attention since I was a small boy. Then Father Langstroth's work had just been issued and a member of our family became very enthusiastic over this as well as his new hive, and this was followed by the building of a house apiary which like most house apiaries proved a complete failure.

I look back with self pity when I think of the struggle I had to get a start in bee-keeping. Opposed by all and assisted by none. What strides has this pursuit taken since then and while the beginner may not have certain traits of character developed so rapidly, he certainly finds more flowers along his pathway.

The first essential to success is a good location. No one should stay in a poor location simply because they happen to be located there. Speaking in a general way I should say go where the land is rich.

The yard should be so located that the very cold winds be cut off and remote enough buildings and highways not to interfere with either men or animals.

You will then want a good race of bees. I believe it is conceded by our best men that all things considered we have nothing better than the Italian race. As some strains of a race are much better than others it will be well to secure only the best by consulting with those who have had a long experience with that particular race. Having once secured such stock considerable attention may profitably be given to breeding from those colonies which show the most desirable traits and by doing this for a number of seasons you will find that you have a much better strain of bees than you could buy and something sought after if you wish to sell.

Another important factor is to prepare all supplies needed, such as hives, sections, etc., during the winter when they can be had at a reduced price and thus save both time and money in the busy season when every moment is valuable. It is a rare thing to find a money maker among our number who fails to do this.

Having gotten ready all the necessary supplies needed we now find spring at hand and we wish to be helpful to the bees in any way we can. There are several important things we can and must do and one of those is to see that each colony has not only stores enough to keep it alive but they must have enough to feel prosperous, as it is a well known fact that bees economize their stores when the amount is small and so do not have the maximum amount of brood.

Another very important point is retaining the heat that a colony generates. Avoid opening hives on cold days and keep in as much heat as possible by keeping the frames well covered with enamel cloth or paper. I was once asked why a certain man was always able to produce more honey per colony than his neighbors, and on visiting him found as I expected an extra well informed bee-keeper who talked very freely and said that he always wrapped each hive in paper when it came out of the cellar and gave the paper much credit for increasing his crop by retaining heat and thus encouraging the bees to have a large amount of brood. While this was not new to me as I had seen it practiced by the best men in N. Y. State, it demonstrated the value of retaining heat.

I have seen hundreds of colonies of bees in early spring sitting on their summer stands with nothing to retain their heat except two pieces of boards laid over the frames. In fact it was the practice of the entire neighborhood, and it is needless to add that their average crop was very small.

As nearly all our large bee-keepers clip their queens, about the first handling of frames will be for this purpose, and you will select a day for this work that is warm with some honey coming in that you may neither chill the brood nor be annoyed by robbers. This will be a good opportunity to see that each colony has a laying queen and clean out any dead bees or do any other necessary work.

Many years ago the man who taught me the rudiments of modern bee-keeping told me that the strongest colony in the spring would not produce the most honey, but the most productive ones would be colonies of average strength. This I found to be true and eagerly sought for the cause. After a time I found that the very strong colonies secured much more of the early or spring flow of honey and having no sections to store it in they crowded the amount of brood down to a comparatively small amount so that when the main harvest came the colony that was strong early was not in as good condition to gather a crop as the colony was that had been too weak in the earlier part of the season to clog the brood nest.

The remedy is to either extract the surplus honey from the brood nest or else put on a case of sections with a number of bait sections in each case that the bees may be quickly interested in the sections and so relieve the brood nest.

If you can get a colony well at work in the sections before they feel crowded in the brood nest they may not have a desire to swarm and such colonies are always great producers of comb honey.

By being careful to put sections on each colony at the proper time you will usually avoid having the yard get the swarming fever which is usually fatal to securing a good crop. I have practiced this plan for years and have never had a yard so demoralized, but might in some localities.

If you are a producer of extracted honey, to the foregoing I would add, have a very large hive holding fourteen frames and when the season is far enough advanced place another of the same size on top of it and allow the queen to lay in as many frames as she chooses. If you have a good strain of bees the results will surprise you. I have made an average on a yard by this method as high as $242 per colony and left 40 pounds for winter stores. The bees were not allowed to swarm however. In fact with this system but very few will care to.

As the honey season draws to a close it will be necessary to watch that neither too many nor too few sections are given the bees. As the honey is taken from the hive it should be stored in a warm dry room secure from the bees where it can be cleaned and crated for market.

A market can be found for a large amount at or near almost any apiary by judicious advertising. In some localities I find that no one cares to produce extracted honey, but when any is offered it is eagerly bought. I call these things to your attention that you may not neglect your home market.

It is very essential that your bees go into winter quarters with plenty of stores and to that end it is well during the latter part of September to carefully examine each colony and satisfy yourself that they have a good queen and plenty of food.

If they can not be supplied with the latter by drawing combs from their prosperous neighbors then feeding should be done at once as this allows the bees to properly ripen and cap these added stores. All bees in single walled hives should be wintered in a good cellar that is frost proof if not packed with proper material on their summer stands. Care should be taken that they are not disturbed by rats or mice. A careful use of poison will usually prove effective.

In order not to weary you I have touched but briefly on many points, but will say in conclusion, Do the right thing at the right time. This is the secret of the successful bee-keeper.

CHARLES STEWART.

*Sammonsville, N. Y.*

A motion was made, and unanimously carried, that we extend a vote of thanks to Mr. Stewart for his excellent paper.

A bill of two dollars and forty cents ($2.40) for badges was presented and ordered paid.

A vote of thanks was extended to Dr. Phillips, Mr. Root and Mr. Stewart for their able assistance in making the meeting a success.

It was decided that the Constitution and By-Laws be printed in our next Annual Report.

The Question Box was opened and the questions thoroughly discussed.

In establishing the Department of Apiculture in the State Museum, Prof. Surface asked for samples of different kinds of honey, at least a pint or section of each kind, to be sent him at his expense, for permanent exhibition, with the name and address of the contributor.

Mr. E. R. Root gave us a very interesting talk, touching on a number of subjects and especially on comb honey and the pure food law.

The Committee on Resolutions reported as follows:

## Report of the Committee on Resolutions.

We, the members of the Pennsylvania State Bee-Keepers' Association, in convention assembled, at Harrisburg, January 17 to 19, 1907, offer the following resolutions as an expression of our feelings:

*Resolved,* That we express our approval and appreciation of the efforts and work of Prof. H. A. Surface in the interests of the science of Apiculture and of this association, and only regret that he has found it impossible to serve us further in the capacity of presiding officer, but feel confident of his continued interest in our work and such aid as he can possibly find time to give us.

*Resolved,* That we extend our thanks to Dr. E. F. Phillips for his attendance and careful presentation of his most valuable paper, and to the chief of the Bureau of Entomology of the U. S. Department of Agriculture for permitting Dr. Phillips to attend this convention and that a copy of this resolution be sent to him.

*Resolved,* That we express our appreciation of the valuable help and encouragement given us by Mr. Charles Stewart, State bee inspector of N. Y., and that we also express our thanks to the Commissioner of Agriculture of the State of N. Y. for allowing Mr. Stewart to be with us, and that a copy of this resolution be sent to him.

*Resolved,* That we thank our retiring officers for their untiring efforts in behalf of this association.

*Resolved,* That this association recommend such legislation in the

State of Pennsylvania as will provide for the proper inspections of apiaries and the suppression of the diseases of bees and also for a law prohibiting the spraying of trees while in blossom with poisonous materials which is injurious to the fruit as well as to the honey bee.

*Resolved,* That we extend to the National Bee-Keepers' Association an invitation to meet in this state and city next fall, and that a copy of this resolution be sent to each officer and member of the board of directors of that organization.

*Resolved,* That the members of the Pennsylvania State Bee-Keepers' Association collectively and individually recommend and urge upon the Governor the re-appointment of Prof. Surface as Economic Zoologist of this state for continuing the work which has so much helped us by both his State and personal experiments, publications and letters.

*Resolved,* That we express the thanks of the Pennsylvania State Bee-Keepers' Association to Dr. N. C. Schaeffer, Superintendent of Public Instruction, for kindly granting us free use of the audience room of his department; and also to the State Librarian, Hon. T. L. Montgomery, for facilities for exhibitions. We also ask the secretary to forward a copy of these resolutions to each of the State officers herein named.

R. D. Barclay,
John Rein,
*Committee.*

The meeting was closed at 12 o'clock, and as the feeling of good fellowship was felt through the closing sessions, the members wended their way homewards feeling that it was good for us to have met together.

Franklin G. Fox,
*Secretary-Treasurer.*

## The Fourth Annual Meeting of the Pennsylvania State Bee-Keepers' Association.

The Association met in the Department of Public Instruction, in the State Capitol building, on October 29th, 1907.

The meeting was called to order by the President, Prof. H. C. Klinger, about 1:00 p. m., and opened with prayer by Mr. Wm. A. Selser.

The minutes of the previous meeting were read by the Secretary, F. G. Fox, and approved as read. A motion was made that they be recorded as the Fifth Annual Meeting of the Association. Motion carried.

The report of the Secretary was next presented and adopted as read. This report showed that while the past season, in general, was a very poor one, yet a fair to good crop of honey had been secured in some parts of the State. This was particularly true where the bee-keepers used hives larger than the eight framed, or where stimulating feeding had kept the bees breeding through the cold, backward spring, so that they were ready for the honey flow when it came.

As foul brood has again manifested itself in many parts of the State, the urgent need of legislation to assist in its control and final eradication was again brought home to the bee-keepers. The Secretary recommended that hereafter a fixed salary be pail to the Secretary-Treasurer for his services.

The membership has shown an encouraging growth, and the outlook of the Association is very promising.

The Treasurer's report was next presented, as follows:

| | | |
|---|---|---|
| *Receipts* | | |
| Received of L. R. White, | $75 59 | |
| Received for dues, | 75 00 | |
| Total receipts, | | $150 59 |
| *Expenditures* | | |
| Dr. E. F. Phillips, | $ 6 20 | |
| Charles Stewart, | 15 00 | |
| Badges, | 2 40 | |
| Dues to National, | 37 00 | |
| Envelopes and postage, | 10 91 | |
| Expressage, | 85 | |
| Printing, | 6 78 | |
| Total expenditures, | | $ 79 14 |
| Balance in hand, | | $ 71 45 |

F. G. Fox,
*Secretary-Treasurer.*

A motion was made and seconded that the report of the Treasurer be accepted, and a vote of thanks be given him for the able manner in which he had financiered the Association. Motion carried.

The report of the Committee on Dues, which had been appointed at the last meeting, to see what could be done towards arranging dues between the local, state and national associations, was given by F. G. Fox. After the matter had been thoroughly discussed, it was laid on the table.

Prof. H. A. Surface, as chairman of the Committee on Legislation, reported on the work that the committee had done. A bill drawn up and presented by Mr. Carson, was referred to a committee, which when they met, conferred with the legislation committee that had been appointed, and the bill was reported out of the hands of the committee at once. During the rush of the last days of the Legislature, the bill was not called up, and with more than a hundred other bills, was laid asleep.

Prof. Surface recommended that we agree on a bill to be presented to the next Legislature. He then read the bill that had been presented and called for criticism on the same. The bill was as follows:

Legislature of Pennsylvania

File of the House of Representatives.

No. 633, Session of 1907.

Mr. Carson, In Place, March 27, 1907
Mr. Nesbit, Agriculture, April 10, 1907.

An Act

For the suppression of contagious diseases among bees in Pennsylvania by creating the office of Inspector of Apiaries to define the duties thereof and to appropriate money therefor.

Section 1. Be it enacted by the Senate and House of Representatives of the Commonwealth of Pennsylvania in General Assembly met and it is hereby enacted by the authority of the same, That upon the recommendation and nomination of a majority vote of the Pennsylvania State Bee-Keepers' Association or by the Economic Zoologist and the Secretary of Agriculture the Governor shall appoint for a term of two years a State Inspector of Apiaries who shall if required produce a certificate from the Governor that he has been so appointed. He shall be subject to summary removal for neglect or malfeasance in office on complaint of the Pennsylvania State Bee Keepers' Association or of twenty persons who are actual bee keepers, his successor to serve for the balance of his unexpired term.

Section 2. The inspector shall inspect bees kept in the State of Pennsylvania and when notified in writing by the owner of an apiary or by any three disinterested taxpayers examine all reported apiaries and all others in the same locality not reported and ascertain whether or not the disease known as foul brood or any other disease which is infectious or contagious in its nature and injurious to honey bees in their egg larval or adult stage exists in such apiaries and if satisfied of the existence of any such disease he shall give the owners or caretakers of the diseased apiaries full instructions how to treat such cases as in the inspector's judgment seems best.

Section 3. The inspector shall visit all diseased apiaries a second time and if need be burn all colonies of bees that he may find not cured of such disease and all honey and appliances which would spread disease without recompense to the owner, lessee or agent thereof.

Section 4. If the owner of any apiary, honey or appliances wherein disease exists shall sell, barter or give away or move without the consent of the inspector any diseased bees (be they workers or queens) honey or appliances or expose other bees to the danger of such disease or fail to notify the inspector of the existence of such disease said owner shall on conviction be liable to a fine of not more than one hundred dollars nor more than two month's imprisonment.

Section 5. By the enforcement of the provisions of this act the State Inspector of Apiaries shall have access, ingress and egress to and from all apiaries or places where bees are kept and any person or persons who shall resist, impede or hinder in any way the inspector of apiaries in the discharge of his duties under the provisions of this act shall on conviction be liable to a fine of not more than one hundred dollars or not more than two months' imprisonment in the county jail. All fines to be turned into the State Treasury.

Section 6. After inspecting infected hives or fixtures or handling diseased bees the inspector shall before leaving the premises or proceeding to any other apiary thoroughly disinfect any portion of his person and clothing any tools or appliances used by him which have come in contact with infected material and shall see that any assistant or assistants with him likewise thoroughly disinfect their person and clothing and tools and implements used by them.

Section 7. It shall be the duty of any person in the State of Pennsylvania engaged in rearing of queen bees for sale to use honey in the making of candy for use in mailing cages which has been boiled for at least thirty minutes. Any such person engaged in the hearing of queen bees shall have his queen-rearing apiary or apiaries inspected at least twice during each summer season and on the discovery of the existence of any disease which is infectious or contagious in its nature and injurious to bees in their egg larval or adult stages, said person shall at once cause to ship queen bees from such diseased apiary until the inspector of apiaries shall declare the said apiary free from all disease. Any person violating the provisions of this section shall be deemed guilty of a misdemeanor and upon conviction thereof subject to a fine of not more than two hundred dollars.

Section 8. The inspector of apiaries shall make monthly reports to the Economic Zoologist giving the number of apiaries visited the number of diseased apiaries found, the number of colonies treated, also the number of colonies destroyed by fire and the expense incurred in the performance of his duty. He shall also keep a careful record of the localities where the diseases exist, but this record shall not be published, but can be consulted by any citizen interested.

Section 9. There is hereby appropriated out of any moneys in the State Treasury a sum not exceeding three thousand dollars per year for the suppression of contagious disease among bees in Pennsylvania.

The inspector of apiaries shall receive four dollars per day and traveling expenses for actual time served which sum shall not exceed the moneys hereby appropriated to be paid by the State Treasurer upon warrants drawn by the Auditor General and shall be authorized to employ such temporary aid as he may need at a salary of not more than three dollars per day and expenses.

Section 10. All acts and parts of acts inconsistent herewith are hereby repealed.

Section 11. This act shall take effect immediately.

W. A. Selser moved that the report of the committee be accepted with thanks, and the committee be continued. Motion seconded and unanimously carried.

Prof. Surface then spoke of the importance of the bee keepers to urge upon the legislators the necessity of such a law when the next Legislature convenes.

Pres. H. C. Klinger then gave the president's annual address, as follows:

## President's Address.

### Prof. H. C. Klinger

*Ladies and Gentlemen,—*

It gives me pleasure to greet you again in our annual convention. Another year has passed and with it have been the successes and the failures incident to our work. The crop of honey taken during the year has been below the average and in some sections a total failure, yet the pleasure that came from the work among "the little fellows" amply paid us for the time and pains expended.

Let it be said for the work of the Association that the Legislative Committee appointed at our last convention drew up a bill for the suppression of foul brood and the appointment of a State Inspector of Apiaries and had it introduced into the State Legislature. The bill was called out of committee, before which your president and the chairman of the Association committee appeared. It passed as far as second reading, but met the same fate that befell numbers of other bills; the Legislature adjourned before reaching its place on the calendar. Although nothing definite has been accomplished in securing legislation, the way has been opened for the passage of needed laws. The securing of such laws as the Association may want will be made the more certain by personal work and efforts with the members of the Legislature during its session when bills are before it.

It might not be necessary to emphasize the object and importance of our organization, but for the fact that ideals must ever be kept in mind even after we have attained them, and there are ends worthy of our best efforts far above what we have already reached. The results of the organization of those who are engaged in kindred occupations are apparent everywhere. The mutual help and sympathy and good fellowship that obtain from the banding together of those who are studying and handling the most wonderful of all insect creations—the honey-bee—stimulate to greater efforts and better results in the work of Apiculture.

Bee-Keepers must be educators. There are many people who today do not know the value of honey as a food; who even do not know from what it is obtained, and much less the way in which the comb is built and the nectar put into the little cells. I have known persons to become regular customers when the interesting story of the bee and honey was told them, especially when they were presented with a box of fine honey. Doing this latter thing may seem expensive advertising, but it invariably brings a new customer and frequently a steady customer. We must advertise.

The pretty teacher was absent from the schoolroom and Billy wrote on the blackboard: "Billy Jones can hug the girls better than any boy in school." Upon her return the teacher called him up to her desk. "William, did you write that?" she asked. "Yes, ma'am," said Billy. "Well, you may stay after school," she said, "as punishment." The other pupils waited for Billy to come out and then began guying him. "Got a licking, didn't you?" "Nope," said Billy. "Got jawed?" "Nope." "What did she do to you?" they asked. "Shan't tell," said Billy; "but it pays to advertise."

We need to teach our fruit people that they have no better friend than the little bee. They are benefitted more by it and its keeper than the bee-keeper receives in return. The bee aids in the pollenation of flowers. Many flowers would remain entirely barren without the aid of some insect. Nature paints the flower with beautiful colors to attract the eye of the insect and puts nectar deep down in the cup so as to compel the bee or other insect to pass the pollen holders on his way down to get his drink. The pollen dust clings to the hairs on his legs and body and is carried to other flowers which are fertilized in this way.

Our friends need also to know that spraying during fruit-bloom is not only injurious to bees but that it defeats the very purpose of spraying, by destroying the pollen when it is most needed to perform its functions.

And now, fellow bee-keepers, we need more education ourselves. We have made considerable progress in the art of bee-keeping, but we have not reached the best. We can do better next year than we did this year. We can produce a better grade of honey. We perhaps do not need more bee-keepers in the field so much as to improve "what there are of us." Some of our methods need improvement. We should put into practice more what we know and preach. If we want to progress, we must watch for the best that is taking place and to do so must carefully read our journals. We have not yet learned all. It is doubless that we will. It is not yet settled as to what is the best method of wintering, nor what is the best strain of bees to keep. There are so many, the beginner scarcely knows what color or kind to select—the black, the brown, the leather-back, the gray, the yellow, the golden, the stingless or the swarmless. Then we are undecided on the swarming plan; whether we shall prevent them, let them or shake them. And now some one springs an entirely new idea—two queens in a hive. Will it work? Are the results greater than with only one queen in a hive? Will both queens live peaceably together? I imagine a case of trouble similar to the following: Mr. Gray, who was a widower and a large family, married Mrs. Brown, a widow who also had a number of children. In the course of years there were more children to bless their union. One evening a great racket in the back yard disturbed them. "Go out and see what is the matter," said Mr. Gray. Mrs. Gray-Brown after looking, came in and said, "Nothing much is wrong, it is only your children and my children fighting with our children."

In order to combat successfully against the dread disease—foul-brood, it will be necessary to use organized effort. In the first place it will require personal influence to be brought to bear on our legislators that they will place our industry in this state on equal footing with other states, a number of which have foul-brood laws and State Inspector of Apiaries.

Then we need the co-operation of all the bee-keepers in the State. All the members of the Association can aid in this by sending in the names of the bee-keepers in their vicinity to the President or the Secretary of the Association, and by using their influence in securing new members. In union there is strength.

The following names were referred to the Executive Committee to be reported upon before electing them as members of the Association:

J. W. Saunders, Rockville, Md.
Long and Fealy, Fairfax, Va.
Chas. J. Gilliss, Haymarket, Va.

A motion was made and seconded that the officers be nominated by ballot; motion carried. The election was then held with the following results: Prof. H. C. Klinger, of Liverpool, was re-elected President; C. N. Green, I. F. Miller and George Rea were elected Vice-Presidents; A. F. Satterthwait, of Harrisburg, was elected Secretary-Treasurer.

A motion was made and carried that we decide upon a candidate to vote for as a member of the Board of Directors of the National.

On motion the meeting adjourned, to meet at 7:30 P. M.

### *Evening Session.*

The meeting was called to order by President Klinger. The committee on the candidates reported favorably and they were unanimously elected as members of our Association. The committee on dues reported that they deemed it advisable that twenty five cents of the dues of the local association be allowed to remain with them and the remaining seventy-five cents be turned over to the state and national associations. The report was accepted and the committee discharged. Motion made and seconded that the report be laid on the table. After much discussion both pro and con the motion carried.

The subject of salarying the secretary-treasurer was next taken up. After thorough discussion of the subject, a motion was made that the Association hereafter pay the sum of twenty dollars to the secretary-treasurer as a compensation for his work. Motion carried.

Geo. Rea, J. D. Hull and E. S. Hacker were appointed as a committee on resolutions.

A motion was made and carried that we support Prof. H. A. Surface in the coming election as a candidate for the Board of Directors of the National.

A motion was made that our present Secretary be authorized to notify the different bee journals of the action of this body as to our representation on the Board of Directors of the National Association and our desire in this matter. Motion carried.

Motion made and seconded that we hold our next meeting in York, Pa., next October. Motion carried.

Prof. H. A. Surface gave a very interesting talk on Bee Sting Cure for Rheumatism, giving a method by which, by the use of a hyperdermic syringe, the formic acid could be injected under the skin, causing no pain, and the rheumatism or lumbago would disappear in forty-eight hours. This does not cure in every case, but is a cure in the greater majority of cases.

Pond's Extract of witch hazel will relieve the swelling and pain of a bee sting.

Mr. Reneker, who has had considerable experience with rheumatism and bee stings as a cure, stated that he had received a severe stinging with the bees and had been completely cured of rheumatism ever since. He has also been an immune to the sting of the bee as a result of the stinging fracas.

Mr. France cautioned people who were affected with scrofula to beware of bee stings, for it is liable to prove fatal to them in a few minutes. Prof. Surface gave it as his personal opinion that a superabundance of bee stings caused a bloodless condition; that is a lack or insufficiency of red corpuscles with an excess of white corpuscles. Mr. Holterman found it advisable to keep some strong stimulant at hand to be used in case of severe stinging, when the heart is affected. Spirits of ammonia was suggested to be used in such cases. President Klinger cited an instance where his aged father had been rheumatic and was stung a number of times on the knee while hiving a swarm, and had had no rheumatism since. This was three years ago.

A motion was made and seconded, that the executive committee of this Association be empowered to send a man to aid or assist in the organization of local associations, as they deemed best. Motion carried. On motion the meeting adjourned.

October 31st, 1:30 p. m. A meeting was called to finish up some things that had been left over from the preceding day.

President Klinger called the meeting to order. The Committee on Resolutions offered the following report:

We, the members of the Pennsylvania State Bee-Keepers' Association in convention assembled at Harrisburg, Pa., Oct. 29, 1907, offer the following resolutions:

*Resolved,* That we express the thanks of the Pennsylvania State Bee-Keepers' Association to Dr. N. C. Schaeffer, Superintendent of Public Instruction, for granting us free use of the auditorium of his department for our meeting, and also the use of the adjoining room for our exhibitions.

*Resolved,* That we thank the Department of Agriculture, Washington, D. C., for granting leave of absence to Dr. E. F. Phillips, Burton N. Gates and Franklin G. Fox, to attend our convention.

*Resolved,* That we thank our retiring Secretary, Franklin G. Fox, for his untiring efforts in behalf of the interest of our association.

*Resolved,* That we thank N. E. France, Geo. W. York and R. F. Halterman, for their presence and interest taken in our State meeting.

*Resolved,* That we recommend individual action by our members to increase the usefulness and membership of our State Association and united action in supporting nominee Prof. H. A. Surface for election as a member of the Board of Directors of our National Bee-Keepers' Association.

GEO. H. REA,
E. S. HACKER,
J. D. HULL,
*Committee.*

The report, on motion, was adopted as read.

Horace N. Van Dyne, Boontown, N. J., was elected a member of the Association by a unanimous vote.

The subject of gathering crop reports was taken up and discussed. It was decided that we refer the subject of publishing statistics to the President and the Secretary.

A motion was made and carried that the report of this year's meeting be incorporated with last year's report.

R. F. Halterman was unanimously elected a member of our Association.

Mr. Hilton gave a very interesting talk on foul brood legislation. He urged that every member write to his representative when the bill is presented, and then its passage is secure.

A motion was made that we extend our hearty thanks to President H. C. Klinger for the time and money he spent in behalf of legislation during the past winter. Motion seconded and unanimously carried.

Vice-President George Rea suggested that we publish notes on this meeting in our local papers.

The President called a meeting of the Executive Committee to make some preliminary arrangements for the York meeting.

No further business appearing, on motion, the meeting adjourned.

FRANKLIN G. FOX, *Ex. Sec.*
205 9th St., S. W., Washington, D. C.

## CONSTITUTION OF THE PENNSVLVANIA STATE BEE-KEEPERS' ASSOCIATION.

### ARTICLE I.

This Association shall be known as the Pennsylvania State Bee-Keepers' Association.

### ARTICLE II.

The object of this Association shall be the promotion of scientific and practical bee culture, and the securing of such legislation as is necessary to protect and further the bee-keeping industry.

### ARTICLE III.

The officers of this Association shall be a president, three vice-presidents, a secretary, a treasurer, and an executive committee of five members, all of whom shall be members of this Association.

### ARTICLE IV.

Any person complying with the regulations of this Constitution and paying one dollar ($1.00) yearly to the funds thereof, shall be a member and shall be entitled to vote at the annual election of officers and to participate in the deliberations of this association.

### ARTICLE V.

Any person interested in bee culture, including ladies, may become honorary members of this Association by a majority vote at a regular meeting.

### ARTICLE VI.

A meeting of the Association for the election of officers shall be held at such time and place as the Association shall direct. Seven members shall constitute a quorum for the transaction of business, but a less number may enter upon the discussion of important topics and adjourn to some future day.

### ARTICLE VII.

Special meetings may be called by the President and Secretary.

### ARTICLE VIII.

This Constitution may be amended by a majority vote at any regular meeting, of which amendment 30 days previous notice shall have been given in writing to every member of this Association.

## BY-LAWS OF THE PENNSYLVANIA BEE KEEPERS' ASSOCIATION.

### ARTICLE I.

*Sec.* 1.—The name of the Association shall be the Pennsylvania State Bee Keepers' Association.

*Sec.* 2.—The officers of this Association shall consist of the President, three (3) Vice-Presidents and a Secretary and Treasurer.

*Sec.* 3.—The Executive Committee of this Association shall consist of the elective officers of the Association.

*Sec.* 4.—The officers of this Association shall be elected by a majority ballot or by a rising vote. If no opposition the ballot shall be cast by the Secretary.

*Sec.* 5.—The officers of this Association shall be elected at each annual meeting.

### ARTICLE II.

*Sec.* 1.—It shall be the duty of the President to call and preserve order in all meetings of the Association; to call for reports of officers and decide upon all questions of order, according to the regular Constitution and By-Laws of the Association, and in accordance with parliamentary usage, and at the expiration of his term of office to deliver an address or cause an address to be given before the Association.

*Sec.* 2.—It shall be the duty of one of the Vice-Presidents, in the absence of the President, to perform the duties of that office.

*Sec.* 3.—It shall be the duty of the Secretary-Treasurer to report all proceedings of the Association, and to record the same, to file and preserve all papers belonging to the Association, and to receive the annual dues and other moneys belonging to the same, giving his receipt for the same; to record the name and address of each member of the Association; to keep a statistical table showing the number of colonies owned in the spring and fall, and the amount of honey and wax produced by each member, together with such other information as may be deemed important, or be directed by the Executive Committee; to give notice to members when they become in arrears with dues; also to keep and bank in the name of the Association the funds of the Association, and to pay them out upon the order of the Chairman of the Executive Committee, each voucher being decided upon by a vote at a regular meeting of the Association; to render a report of all receipts and expenditures, number of members in good standing, number in arrears, if any, at each annual meeting; and to give notice of all meetings of the Association in the leading papers of the State and in the Bee Journals, at least four weeks prior to the time of meeting.

*Sec.* 4.—The Secretary-Treasurer shall have power to choose an Assistant Secretary if, in his discretion, he deem it necessary.

*Sec.* 5.—An appropriation of $15.00 shall be made at each annual meeting and placed in the hands of the Secretary-Treasurer, to pay postage and stationery expenses of the Association for the ensuing year.

### ARTICLE III.—COMMITTEES.

*Sec.* 1.—The President shall at the commencement of his regular term appoint a committee on legislation to consist of five members, whose duty shall be to aid, urge and encourage the enactment of laws for the benefit of the Bee Keepers.

*Sec.* 2.—It shall be the duty of the Executive Committee to select subjects for discussion, and appoint members or others to deliver addresses or read essays, and to transact all interim business.

## ARTICLE IV.

The place and time of the next regular meeting of this Association shall be decided by a majority standing vote at each regular meeting.

## ARTICLE V.

The Association shall be mainly governed by the following order of business:

Prayer.
Calling of Roll.
Reading Minutes of last meeting.
Reception of new members.
Collection of dues.
Secretary-Treasurer report.
Report of Standing Committee.
President's Address.
Election and installation of officers.
Miscellaneous business.
Discussions.
Adjournment.

## ARTICLE VI.

The officers of this Association shall cause the Constitution and By-laws to be printed in appropriate form, and every person joining the Association shall be mailed a copy of the same.

## ARTICLE VII.

These By-laws may be amended by a majority vote of all the members present at any regular meeting of the Association, provided 30 days' written notice embodying the proposed change shall have been mailed or given each member of this Association.

R. B. Hayes,
E. A. Dempwolf,
J. S. Sparks.

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## A Suggestive Page of Bee-Keeping Records of 1907.

| NAME AND ADDRESS. | Colonies, in spring. | Colonies, in fall. | Combhoney, pounds. | Comb honey, sections. | Extracted honey, pounds. | Wax, pounds. | VARIETIES OF BEES. | HONEY-PRODUCING FLOWERS. | Kept bees, years. | Wintered on summer stands. | Wintered in cellar. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Miss C. L. Bamberger, Lebanon, | 2 | 3 | ---- | ---- | ---- | ---- | Italians, | ---- | 1 | Yes | ---- |
| H. K. Beard, Manheim, R. 6., | 4 | 8 | 300 | ---- | ---- | ---- | Italians, Banats and hybrids, | White clover, alsike, apple, dandelion, sumac and some wild plants. | 5 | Yes | ---- |
| Rev. H. A. Bender, Schellsburg, | 10 | 10 | ---- | 180 | ---- | ---- | Italians and Blacks, | White clover, | 7 | Yes | ---- |
| D. C. Blankley, Steckman, | 25 | 29 | 500 | ---- | ---- | ---- | Italians and hybrids, | White clover, sumac, buckwheat, basswood, | 9 | Some | Some |
| F. P. Catherman, Lewisburg, | 28 | 54 | 1200 | ---- | 350 | ---- | Italians and Blacks, | White clover, locust, | 25 | ---- | Yes |
| Wm. Claar, Queen, | 13 | 15 | ---- | ---- | ---- | 10 | Italians and Carneolans, | White clover, sumac, buckwheat, | 15 | ---- | Yes |
| T. J. Dressler, Knousetown, | 34 | 37 | 900 | ---- | ---- | 10 | Italians, Blacks, mixed, | Clover, buckwheat, | 20 | Yes | ---- |
| H. B. Eberly, Williamsport, | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | 2½ | ---- | ---- |
| Wm. S. Ehst, Shanesville, | 15 | 13 | 400 | ---- | ---- | 8 | Golden Italian, Cyprian, | White clover, sumac, | 8 | Yes | ---- |
| Jas. H. Fisher, Fullerton, | 6 | 12 | 100 | ---- | ---- | ---- | Italians, | Clover, | 10 | Yes | ---- |
| Samuel F. Frick, Fricks, | ---- | 24 | ---- | 500 | ---- | ---- | Italians, | Clover, buckwheat, ironweed, golden rod, | 5 | Yes | ---- |
| Daniel Griggs, Montoursville, | 13 | 13 | 100 | ---- | ---- | ---- | Italians (in part), | White clover, buckwheat, dandelion, catnip, smartweed, locust. | 72 | Some | Some |
| E. S. Hacker, Ephrata, | 5 | 10 | 50 | ---- | ---- | ---- | Hybrids, | White clover, alsike, | 5 | Yes | ---- |
| J. K. Haring, W. Waynesburg, | 8 | 14 | 50 | ---- | 150 | ---- | Hybrids, | Aster, | 4 | Yes | ---- |
| J. A .Henderson, State College, | 7 | 9 | ---- | ---- | 278 | ---- | Italian, | White clover, | 8 | Yes | ---- |
| E. T. Hicks, West Chester, No. 2, | ---- | ---- | ---- | ---- | ---- | ---- | Common Black, | White clover, | 2 | ---- | Yes |
| H. Horner, Jenkintown, | ---- | 100 | ---- | ---- | 6600 | 50 | Italian, | White clover, alsike, hearts-ease, aster, | 15 | Some | * |
| L. K. Hostetter, Landis Valley, | ---- | ---- | 500 | ---- | 300 | 10 | Italian, Hybrids and Black, | Clover, poplar, locust, fruit blossoms, | 4 | Yes | ---- |
| William Kernan, Dushore, | 250 | 325 | 2000 | ---- | 3000 | 200 | Carneolans, | Clover, buckwheat, basswood, raspberries, golden rod. | 18 | ---- | Yes |
| H. C. Klinger, Liverpool, | 37 | 49 | 700 | ---- | 265 | 20 | Italians and Hybrids, | White clover, buckwheat, sumac, fruit, | 18 | Yes | ---- |
| D. M. Laudenslager, Mackeyville, | 6 | 10 | 200 | ---- | ---- | 2 | Italians, | White clover, basswood, fruit blossoms, dandelion, sumac, aster, teas, mint, catnip, motherwort. | 10 | ‡‡ | ---- |
| H. M. Moyer, Bechtelsville, R. 2, | ---- | 20 | ---- | 450 | ---- | 30 | Golden Italians, | ---- | 28 | Yes | ---- |
| John H. Miller, Myerstown, | 25 | 35 | 600 | ---- | ---- | 10 | Italians, | White clover, alfalfa, fruit blossoms, | 16 | Yes | ---- |
| A. S. Moyer, Polk, | 18 | 24 | 100 | ---- | 50 | 1 | Italians crossed with Carneolans, | Blackberry, basswood, buckwheat, huckleberry, gum, sumac. | 22 | Yes | ---- |
| N. J. Nelson, Keshequa, | 13 | 16 | 500 | ---- | 200 | ---- | Italians and Hybrids, | Blackberry, sweet clover, wild cherry, Spanish needle, aster, golden rod, sumac, touch-me-not. | 4 | Yes | ---- |

## A Suggestive Page of Bee-Keeping Records of 1907—Concluded.

| NAME AND ADDRESS. | Colonies, in spring. | Colonies, in fall. | Comb honey, pounds. | Comb honey, sections. | Extracted honey, pounds. | Wax, pounds. | VARIETIES OF BEES. | HONEY-PRODUCING FLOWERS. | Kept bees, years. | Wintered on summer stands. | Wintered in cellar. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| E. Noll, Bellefonte, | 8 | 9 | ---- | 1100 | ---- | ---- | Italians, | White clover, sweet clover, catnip, maple, burdock. | 10 | Yes | ---- |
| A. B. Reneker, York, | 15 | 27 | 156 | ---- | ---- | ---- | Italians and Hybrids, | White clover, locust, | 30 | Yes | ---- |
| J. S. Shope, Annville, | 18 | 20 | 450 | ---- | ---- | ---- | Italians to Blacks, mixed, | White clover, locust, alsike, | ---- | Yes | ---- |
| E. P. Starry, Mechanicsburg, | 7 | 8 | 150 | ---- | ---- | ---- | Golden Italian and Hybrid, | White clover, locust, raspberry, | 15 | Yes | ---- |
| Wm. A. and C. E. Stewart, Elkin, | 26 | 42 | 1090 | ---- | ---- | ---- | 3-banded Italian, | Buckwheat, | 5 | Yes | ---- |
| Rev. H. H. Stiles, Altoona, | 10 | 10 | 240 | ---- | ---- | ---- | Italian and Hybrids, | White clover, thistle, golden rod, | 12 | Yes† | ---- |
| F. J. Strittmatter, Ebensburg, | 120 | 118 | ---- | 500 | 1500 | 70 | Italians, | White clover, buckwheat, golden rod, basswood. | 6 | Yes† | ---- |
| Chas. A. Transue, Delaware Water Gap | 3 | 7 | 300 | ---- | ---- | ---- | Italians to Blacks, mixed, | White clover, fruit, buckwheat, golden rod, asters, basswood, dandelion, berries, whitewort. | 2 | Yes | ---- |
| Julius Wagner, Reading, | 35 | 41 | 900 | ---- | 300 | ---- | 3-banded Italians, | White clover, buckwheat, sumac, spider plant. | 18 | Yes | ---- |
| John M. Wallace, Waynesburg, | ---- | 1 | 55 | ---- | ---- | ---- | 3-banded Italians, | Basswood, asters, | 1 | Yes | ---- |
| Hon. E. A. Weimer, Lebanon, | 2 | ---- | 52 | ---- | ---- | ---- | 3-banded Italians and Banats, | Clover, | 6 | ‡ | ---- |
| L. R. White, Jermyn, | 7 | 7 | 350 | ---- | ---- | ---- | Common Black, | White clover, raspberry, heart-weed, basswood, buckwheat, fruit blossoms, sumac. | 3 | ** | ---- |
| Susan E. Williams, N. J., | ---- | 7 | ---- | 80 | 600 | ---- | Italians and Blacks, | Clover, apple, basswood, golden rod, asters, | 3 | Yes | ---- |
| J. R. Wilson, Sr., Carlisle, R. 1, | ---- | ---- | 100 | ---- | ---- | ---- | Italians and Hybrids, | Red and white clovers, | 39 | Yes | ---- |
| H. E. Zech, Seven Valleys, R. 1, | 6 | 12 | 30 | ---- | ---- | ---- | 5-banded Italians, | White clover, alsike, | 2 | Yes | ---- |

*Some buried. ‡In office. **In shed. ‡‡In chaff and air-spaced hives. †Protected.

---

# Dadant's Foundation

## IT EXCELS

Ask any dealer who handles our make along with any other and he will say, "Of conrse, Dadant's is the best.

Ask a bee-keeper who has used our make and he will tell you the same thing. WHY? Because we make the manufacture of foundation OUR SPECIALTY. We devote our time to making the

**The Very Best Comb Foundation that can Possibly be made**

For twenty-eight years we have led in the manufacture of this article. Don't experiment with a new make. GET DADANT'S, insist on Dadant's and you will have the best. It will cost you no more than any other.

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We work beeswax into Comb Foundation for the bee-keeper direct. Send for our prices and catalog. Remember, you take no chances when you get our foundation. We absolutely GUARANTEE SATISFACTION IN EVERY WAY.

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**HAMILTON, ILLINOIS**

# SPRAYING CHEMICALS

## SULPHUR

Flowers Sulphur, 155 pounds to barrel, and Flour Sulphur, 175, 190 and 250 pounds to barrel. We guarantee these Sulphurs for use in the Lime-Sulphur Wash, Etc.

## BLUE VITRIOL (COPPER SULPHATE)

Crystals or Granulated, uniform barrels of 450 pounds each. Strictly neutral quality and unexcelled for use in Bordeaux Mixture, etc. It is important that the Blue Vitriol used in spraying mixtures should not contain "free acid" which is injurious to the foliage.

## ARSENATE LEAD

The best way to avoid wormy fruit is to spray with Arsenate Lead. This chemical is more adhesive than any other form of arsenical—even heavy rains closely following the spraying do not appreciably wash it off. It is recommended by various authorities as being superior to Paris Green, and is considerably cheaper than Paris Green. ***It will not burn the foliage.*** Arsenate Lead is packed in barrels of 400 to 600 pounds; in kegs of 100 pounds, and in kits of 5, 10 and 20 pounds.

## SOLUBLE OIL 95%

This oil is readily and completely soluble in water in any proportion and in any kind of water, hard or soft, hot or cold. Soluble Oil is a highly effective remedy for killing the scale and can be prepared for use in the orchard quickly, in any quantity desired, without the expense of elaborate apparatus. It is non-poisonous and non-corrosive. Soluble Oil is packed in barrels and half barrels, and in one, five and ten gallon kits.

*We are now prepared to offer the Cure-Sulphur Wash in concentrated form*

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**608 BOURSE BUILDING PHILADELPHIA, PA.**

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Always Ready for Shipment

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Prompt, Careful, Courteous Attention to Orders and Inquiries

# END OF YEAR